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THE CONTENT OF SOME MINERAL ELEMENTS IN THE DEFINED GRASS SILAGE SAMPLES

SADRŽAJ NEKIH MINERALNIH TVARI U ODREĐENIM UZORCIMA TRAVNE SILAŽE

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SUMMARY

On M-Kmetijsko gospodarstvo Kočevje 17 grass silage samples were analyzed on some mineral elements content in the year 1992. Grass from which the silage was prepared, consisted of similar botanical components and grew under the same conditions. Grass was ensiled before the drought started. The means for silage (n = 17) in dry matter were: 384.74 g DM kg^{-1}, 93.68 g CA, 6.71 g Ca, 3.21 g P, 2.11 g Mg, 20.51 g K, 0.69 g Na, 23.36 mg Zn (n = 16), 84.49 mg Mn, 968.68 mg Fe and 5.88 mg Cu. The contents were compared with the available data in the literature. It was concluded that the results of element determination have to be continuously checked.

INTRODUCTION

The better genetic capacities the animals possess the more qualitative feed must to fodder plants. This applies even more be given to them in more complete diets. For this kind of feed by quality we do not only the amount of proteins, mean amino acids and energy they contain, but also the amount of particular mineral elements in them. On the basis of all the data mentioned it is possible to give to an animal the most suitable mixture of major and trace elements.

MATERIAL AND METHODS

Samples

In 1992 seventeen samples of grass silage were taken on M-Kmetijsko gospodarstvo Kočevje. Grass, from which the silage was prepared, consisted of quite similar botanical components and grew under the same conditions: soil, precipitation, temperature and agrotechnical treatments. Grass was ensiled from the end of May till the beginning of June which meant before the drought started in that year.

Chemical analyses

In grass and silage the contents of dry matter, crude ash, calcium, phosphorus, magnesium, potassium, sodium, zinc, manganese, iron and copper were detected. The contents of calcium, magnesium and trace elements were measured on the atomic spectrophotometer, the contents of potassium and sodium were measured on flame spectrophotometer and the content of phosphorus spectrophotometrically on the spectrophotometer. Chemical analyses were performed at the values of grass are given in Table 1. The results for sodium, iron, copper and phosphorus rather differ from sample to sample, however in all samples the values are within the normal distribution (mean ± 3 S.D.).

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Table 1. The mean contents of mineral elements in grass, n = 4
Tablica 1 – Prosječni sadržaj mineralnih tvari u travi (n = 4)

	Mean - Prosjek	Median	S. D. ±	C. V. (%)	S. E.
Dry matter (g kg^{-1}) – Suha tvar	325.25	322.00	151.81	46.67	75.90
Crude ash (g kg^{-1}) - Pepeo	81.03	80.10	7.85	9.69	3.93
Calcium (g kg^{-1} DM - ST) – kalcij	6.80	6.34	1.29	19.01	0.65
Phosphorus (g kg^{-1} DM - ST) – fosfor	3.20	3.54	1.07	33.37	0.53
Magnesium (g kg^{-1} DM - ST) – magnezij	1.82	1.74	0.55	30.35	0.28
Potassium (g kg^{-1} DM - ST) – kalij	23.32	23.71	4.66	19.97	2.33
Sodium (g kg^{-1} DM - ST) – natrij	0.71	0.55	0.51	71.91	0.26
Zinc (mg kg^{-1} DM - ST) – cink	23.16	23.52	2.04	8.80	1.02
Manganase (mg kg^{-1} DM - ST) - mangan	50.75	51.10	6.91	13.62	3.46
Iron (mg kg^{-1} DM - ST) - željezo	388.88	313.50	227.25	58.44	113.63
Copper (mg kg^{-1} DM – ST) – bakar	4.45	4.67	2.15	48.28	1.07

RESULTS AND DISCUSION

It is not often the case that several samples of grass silage from the same region are analyzed in the same year. On the other hand seventeen samples are not a lot from the statistical point of view.

The mineral elements content of samples is displayed in Table 2 and mean values in Table 3.

Table 2. The mineral elements content in grass silage dry matter
Tablica 2. Sadržaj mineralnih tvari u suhoj tvari silaže trave

Sample	DM – ST	CA-pepeo	Ca	P	Mg	K	Na	Zn	Mn	Fe	Cu
	g kg^{-1}	g						mg			
1	272.0	97.9	7.47	3.09	2.35	15.01	1.09	16.19	94.7	945.7	7.94
2	251.0	99.4	7.73	2.74	2.11	22.82	0.83	15.24	86.7	945.7	9.52
3	248.7	89.8	5.87	3.94	2.50	24.59	0.33	34.42	95.7	1010.5	7.18
4	291.5	88.5	9.07	3.61	2.78	20.04	1.39	28.95	64.8	779.1	6.15
5	392.8	76.7	6.14	3.59	2.37	18.94	0.57	28.80	79.1	842.2	7.18
6	465.9	89.2	5.60	3.33	1.46	23.04	0.43	25.51	144.0	961.4	5.13
7	617.9	94.9	5.87	3.32	2.70	25.50	0.72	26.13	75.4	736.8	6.15
8	540.8	100.8	7.20	3.56	2.27	23.68	0.74	26.45	94.8	1136.9	5.64
9	565.8	87.7	6.93	2.99	2.12	19.12	9.74	100.62	74.6	1038.6	7.69
10	227.0	107.7	7.73	3.11	1.67	18.12	0.69	25.04	73.9	1866.5	5.13
11	349.7	106.0	5.87	3.84	1.92	20.13	0.70	21.60	100.0	1438.5	4.10
12	349.7	79.3	6.40	3.61	2.13	19.98	0.56	22.81	62.4	701.7	5.51
13	413.4	76.7	5.33	3.35	1.89	21.83	0.48	20.70	103.3	934.2	4.96
14	482.0	99.8	6.80	1.55	1.97	20.47	0.27	24.21	57.6	489.7	7.71
15	394.1	73.8	7.20	2.99	1.89	19.59	0.82	19.30	87.5	1121.3	4.41
16	281.1	117.8	6.93	2.93	2.03	16.37	0.88	15.44	76.5	1000.0	2.75
17	288.8	106.6	5.87	2.95	1.65	19.44	0.52	22.94	65.3	518.8	2.78

Table 3. The mean content of mineral elements in grass silage, n = 17
Tablica 3 – Prosječni sadržaj mineralnih tvari u silaži trave (n = 17)

	Mean - Prosjek	Median	S.D.(±)	C.V.(%)	S.E.
Dry matter (g/kg^{-1}) - ST	384.74	392.80	121.90	31.68	29.56
Crude ash (g/kg^{-1}DM - ST) - pepeo	93.68	94.90	12.53	13.38	3.04
Calcium (g kg^{-1} DM - ST) – kalcij	6.71	6.80	0.97	14.53	0.24
Phosphorus (g kg^{-1} DM - ST) – fosfor	3.21	3.32	0.55	17.10	0.13
Magnesium (g kg^{-1}DM - ST) – magnezij	2.11	2.11	0.36	17.14	0.09
Potassium (g kg^{-1} DM - ST) – kalij	20.51	20.04	2.80	13.64	0.68
Sodium (g kg^{-1} DM - ST) – natrij	0.69	0.70	0.27	39.69	0.07
Zinc (mg kg^{-1} DM - ST) – cink	27.90	24.21	19.42	69.60	4.71
Manganase (mg kg^{-1} DM - ST) - mangan	84.49	79.10	20.67	24.47	5.01
Iron (mg kg^{-1} DM - ST) - željezo	968.68	945.70	325.68	33.62	78.99
Copper (mg kg^{-1} DM – ST) – bakar	58.88	5.64	1.85	31.41	0.45

From Table 2 it can be seen that zinc content in sample No. nine distinguishes considerably from the others. When the results of chemical analyses were checked it showed that the results for zinc in sample. No. nine was not within the normal distribution (mean ± 3 S.D.). So the particular result was withdrawn, hence the correct calculations were: mean value = 23.36 mg kg^{-1} DM, median = 23.58 mg kg^{-1} DM, S.D. = 5.26, C.V. = 25.98 and S.E = 1.31.

For sodium, iron and copper the range between determinations is large as well, and coefficients of variation are higher than 30%, but all results are within the normal distribution. In spite of this some results differ from the mean values or median; as is the case with one sample of each phosphorus, sodium, manganese and iron (14th, 4th, 6th and 10th) and three copper samples (2nd, 16th, and 17th). It is well known that legumes contain more phosphorus and copper than grasses (McDonald et al., 1988), and the manganese content among grass contain more calcium, phosphorus, magnesium, potassium, zinc, iron and copper than grasses (Babnik et al., 1996).

When mean values of the samples under investigation were compared to the mean values of the random samples of some other authors some statements could be taken out.

The content of calcium, with certain differences from year to year, corresponds with the results of Pen et al., 1985 (n = 25), Pen et al., 1986 (n = 34), Pen et al., 1987 (n = 22), Stekar and Golob, 1986 (n = 29), Stekar et al., 1987 (n = 57), Stekar et al., 1988 (n = 57), Stekar et al., 1989 (n = 48), Stekar et al., 1990 (n = 41), Stekar et al., 1991 (n = 23), Stekar et al., 1993 (n = 36), Rajčevič et al., 1994 (n = 1), Rajčevič et al., 1995 b (n = 6), Nehring et al., 1970, Stevenson and Unsworth, 1978 (n = 292), while Kellner and Becker, 1971 and Rajčevič et al., 1995 a (n = 1) cited rather lower values.

The content of phosphorus is rather near to the results of Pen et al., 1985 (n = 25), Pen et al., 1986 (n = 34), Pen et al., 1987 (n = 22), Stekar and Golob, 1986 (n = 29), Stekar et al., 1987 (n = 57), Stekar et al., 1988 (n = 57), Stekar et al., 1989 (n = 48), Stekar et al., 1990 (n = 40), Stekar et al., 1991 (n = 23), Stekar et al., 1993 (n = 36), Rajčevič et al., 1995 b (n = 6), Kelner and Becker, 1971, Stevenson and Unsworth, 1978 (n = 292). Authors Nehring et al., 1970, Rajčevič et al., 1994 (n = 1) and Rajčević et al., 1995 a (n = 1) cited rather higher values.

The mentioned authors (Pen, Stekar, Rajčevič) quoted a bit higher values for magnesium, the same did Nehring et al., 1970 meanwhile Kellner and Becker, 1971 quoted a very similar value (2.2 g kg^{-1}DM) as it is given in Table 3. (2.11 g kg^{-1}DM); Stevenson and Unsworth, 1978 (n = 292) reported a lower value (1.4 g kg^{-1}DM).

The potassium content is comparable with the majority of mentioned authors. Nehring et al., 1970. found a higher content (36.0 g kg^{-1}DM) and Rajčevič et al., 1995 a, 1995 b lower (12.46 g and 13.90 g kg^{-1}DM).

The sodium content is lower in comparison with Kellner and Becker, 1971 and Stevenson and Unsworth, 1978 (8.00 g and 3.9 g kg^{-1}DM). Very few Slovenian samples, in which the addition of salt was not declared, contained more than 1.0 g Na: Rajčevič et al., 1994 (n = 1) 1,48g, Rajčevič et al., 1995 a (n = 1) 1.56 g and Rajčevič et al., 1995 b (n = 6) 1,04 g. Also the previous investigations showed low contend of sodium. Stekar and Pen, 1980 established a six-year-mean-value of 0.77 g kg^{-1}DM (n = 156). However, Nehring et al., 1970 detected a low value too (0.5 g kg^{-1}DM).

For the zinc content it should be said that Pen, Stekar and Rajčevič including Orešnik (1994) found higher values as a rule; Kellner and Becker, 1971, Nehring et al., 1970, Stevenson and Unsworth, 1978, found similar values as were detected in the discussed silage samples (21.0 mg, 28.0 mg and 30.5 mg in kg DM).

For the manganese content it could be mentioned that it was in agreement with the values of Kellner and Becker, 1971 Nehring at all., 1970 and Stevenson and Unsworth 1978 (65.0 mg; 81.0 mg and 99.2 mg in kg DM) while Pen, Stekar, Rajčevič and Orešnik got higher contents.

The iron content is high. In the literature it was not possible to find values like that, although Rajčevič et al., 1994 (n = 1) quoted a similar one (997.67 mg kg^{-1}DM) still Rajčevič et al., 1995 (n= 1) detected a lower one (200.24 mg kg^{-1}DM). Kellner and Becker, 1971 quoted 410 mg kg^{-1} DM, Nehring et al., 1970 151 mg/kg. There are not many data for copper content in the grass silage that are similar to the iron content in it. However Kellner and Becker, 1971 reported 9.5 mg, Nehring et al., 1970, 10.7 mg, Coic and Coppenet, 1989, 6-8 mg, Rajčevič et al., 1995a, 25.87 mg and 5.00 mg, all in kg DM.

CONCLUSION

Since it is not easy compare the mineral element contents in the not well defined samples they should be better described.

It is well known that many factors are involved in mineral element contents in fodder plants (soil, year, botanical composition, stage of growth, season, altitude). We have to be aware that samples could be easily contaminated especially in the case of trace elements, also in the laboratories.

Results of element determinations must be continuously compared (standards, sample exchange).

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SAŽETAK

Na seljačkom gospodarstvu u Kočevju analiziran je 1992. godine sadržaj nekih mineralnih elemenata u 17 uzoraka silaže trave. Trava od koje je pripravljena silaža sastojala se od sličnih botaničnih sastojaka i rasla je u istim uvjetima. Trava je silirana prije početka suše. Srednje vrijednosti suhe tvari u silaži (n = 17) bile su: 384.74 g ST kg^{-1}, 93.68 g pepeo, 6.71 g Ca, 3.21 g P, 2.11 g Mg. 20.51 g K, 0.69 g Na, 23.36 mg Zn (n = 16), 84.49 mg Mn, 968.68 mg Fe i 5.88 mg Cu. Sadržaj je uspoređen s dostupnim podacima u literaturi. Zaključeno je da se rezultati određivanja elemenata moraju neprekidno kontrolirati.

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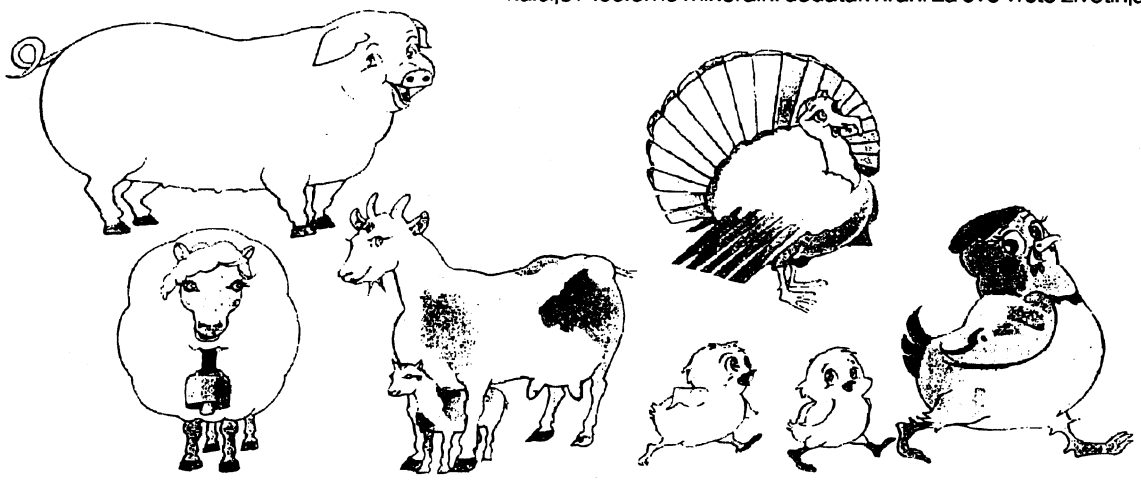

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