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GRASS SILAGE AS A SOURCE OF MACROELEMENTS

TRAVNA SILAŽA KAO IZVOR MAKROELEMENATA

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ABSTRACT

Kmetijsko gospodarstvo Kočevje owns about 2000 ha of grassland. Each year about 9000 t of grass silage is prepared. In winter rations for dairy cows there is approximately 30 kg of grass silage. Beef cattle are given grass silage ad lib., up to 20 kg daily. In 1992, 38 samples of grass silage were analysed. The mean content of dry mater (DM) was 333.5 g. kg^{-1} and of crude ash 97,41 g. kg^{-1} DM. Mean contents of some essential macro elements per kg DM were: calcium 6,98 g; phosphorus 3,04 g; magnesium 2.23 g; potassium 18,22 g and sodium 0,70 g. Taking into account the mean content of DM in silage the animals consumed the above stated quantity of elements by 3 kg of grass silage.

INTRODUCTION

It is more difficult to produce quality grass silage with high nutritive value on large farms than on small ones even if large farms are better equipped with machines. Therefore, the experts who work on the Kmetijsko gospodarstvo Kočevje pay a special attention to silage. Kmetijsko gospodarstvo Kočevje owns about 2000 of grassland and prepares approximately 9000 t grass silage a year. Before including grass silage into winter rations of dairy cows and beef cattle the quality, crude protein content, energy value and in vitro digestibility are monitored. Cows are given 30 kg grass silage a day while fattening bulls consume it ad libitum - up to 20 kg a day. Since the amounts in the ration are so big it is good to know the mineral content of silage since it is not well known how many minerals are lost in ensiling.

MATERIAL AND METHOD OF WORK

The silage was prepared at the end of May and beginning of June 1992, in usual weather conditions before the dry period began. If the weather was suitable, the grass was wilted before it was ensiled. All grass was cut up before being ensiled.

Nine samples were taken for analysis. Average values are stated below. All chemical analyses were performed at Veterinary faculty.

Mean values of dry matter, crude ash and some macro elements in the raw material in g.kg^{-1} dry matter were the following (n=9):

Dry matter	293.60 g.kg^{-1}
Crude ash	80.87
Potassium	24.32
Calcium	6.40
Phosphorus	3.37
Magnesium	1.65
Sodium	0.58

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RESULTS AND DISCUSSION

In Table 1 mean values of element contents in the silage are presented. Two samples which contained more than 200 g crude ash in kg of dry matter (DM) were not included into statistical calculations. Samples were probably polluted by sand that the silage was contained. They contained a lot of calcium, more than 20 g per kg DM, and a lot of magnesium more than 7 g per kg DM.

Table 1 The mean contents (g.kg^{-1} DM) of some elements in grass silage, n=36
Tablica 1. Prosječni sadržaj (g.kg^{-1} ST) nekih elemenata u travnoj silaži, n = 36

	Mean Sredina	Median Medi-ana	sd so	se sn	CV KV
Dry matter, g per kg Suha tvar, g u kg	333.47	291.70	119.17	19.08	35.7
Crude ash Surovi pepeo	102.07	99.60	25.03	4.01	24.5
Potassium Kalij	18.82	19.13	3.46	0.55	18.4
Calcium Kalcij	6.89	6.86	1.28	0.21	18.6
Phosphorus Fosfor	3.04	3.01	0.55	0.09	18.0
Magnesium Magnezij	2.29	2.23	0.42	0.07	18.4
Sodium Natrij	0.70	0.69	0.38	0.06	54.7

The analysed samples of silage were of good quality. The samples were estimated according to Flieg. The samples which contained less than 300 g dry matter per kg got 85 points on average, while the samples with more than 300 g DM got 92 points. Some authors (Henderson and McDonald, 1975; Henderson, 1986, cit. by McDonald et al., 1991) established a significant rise of crude ash content in silage in comparison with its content in the raw material, from 99 to 150 g per kg DM. In our sample the rise was smaller, from 81 g to 102 g DM.

According to DLG tables (1991) grass from grassland contained 95 g crude ash per kg DM (n=16) in such development phase as ours was, while grass silage contained 114 g. kg^{-1} DM (n=30). Kellner and Becker (1971) reported that good new forage from grassland contained 8.0 g calcium, 3.2 g phosphorus, 3.0 g magnesium, 1.5 g sodium and 23.5 g potassium, all in kg of dry matter. Silage from new grass contained 4.1 g calcium, 3.4 g phosphorus, 2.2 g magnesium, 8.0 g sodium and 28.3 g potassium. It is evident that our raw material contained less ash and fewer macro elements, the most significant difference was in the content of sodium. It has already been shown that fresh forage from grassland and grass silage contain less sodium than it had been reported (Stekar and Pen, 1980). The authors presented the mean values for the six year period from 1972 to 1977. Fresh forage from grassland contained 0.56 g Na in kg^{-1} DM (n=56), and grass silage 0.77 g Na kg^{-1} DM (n=156). The mean values for sodium were rather diverse in some years. The following data on mean value of sodium content for forage from grassland and for grass silage, produced in the years 1985, 1987, 1988 and in 1989 are interesting as well: 0.87 g (n=29) and 0.73 (n=29), respectively (Stekar and Golob, 1986); 0.73 (n=39) and 0.67 (n=69), respect. (Stekar et al., 1988); 0.70 (n=21) and 0.70 (n=55), respect. (Stekar et al., 1989); 0.82 (n=38) and 0.55 (n=45), respect. (Stekar et al., 1990). All data are expressed in g.kg^{-1} DM. Table 1 shows that sodium has the highest coefficient of variance. The same can be said for the above mentioned data, although some coefficients of variance were higher, even by 139.85.

The established mean values, except for sodium, matched the data on mean value of elements contained in the grass silage (n=292) which was produced in Northern Ireland (Stevenson and Unsworth, 1987, cit. by McDonald et al., 1991). Mean values were: potassium 18,0 g, s.e. 5.46, calcium 6.2 g, s.e. 1.50, sodium 3.90 g, s.e. 1.62, phosphorus, 3.0 g, s.e. 0.57, magnesium 1.4 g, s.e. 0.50.

Concerning the mean values of dry matter in the silage the above stated amounts of elements are consumed by 3 kg of grass silage. If mean values are considered, the calculation for 30 kg silage which is fed to cows seenes very easy. The same conclusion can be drawn if median is considered. Nevertheless, the consideration of standard deviations is more correct.

If mineral requirements of cows are taken into account various standards differ significantly. The final conclusion has not been made yet.

Standards for calcium and phosphorus (g/day) requirements of a 600 kg cow which gives 30 kg of milk a day differ a great deal:

	Ca	P
ARC (1965)	105	85
NRC (1978)	100	71
INRA (1978)	140	75
ARC (1980)	64	59
DLG (1984)	118	74

Standards for calcium and phosphorus requirements of a 30 kg lamb which gains 200 g a day are the following:

	Ca	P
ARC (1965)	6.0	2.9
NRC (1978)	4.8	3.0
INRA (1978)	7.1	2.8
ARC (1980)	3.7	2.1
DLG (1984)	7.0	3.5

The differences in calcium can be explained by its absorption in the digestive tract. Coefficients of absorption are changed regarding the consumed calcium and calcium reguirements ratio (I/R). The highest the ratio is the smaller is the coefficient of absorption. It is supposed that calcium utilization is not hindered. In ARC standards (1980) the changes in absorption regarding I/R ratio were calculated on the basis of balance experiments with dairy cows. The highest achieved coefficient of absorption was 0.68 which was also used in transformation of net requirementes into nutritive requirements.

INRA (1978) quote smaller coefficients of absorption than expected if I/R ratio is considered because they took into account their experiences from feeding rations with volumionous feedstuffs. The reason is in the power utilization of Ca from such rations, which can prevent the efficiency of utilisation. Therefore smaller coefficients of absorption (0.30 - 0.35) are used in calculation of nutritive requirements, while NRC and DLG standards use the values between both limits.

The ARC standards (1980) have been changed regarding phosphorus requirements. The were diminished too. In 1965, it was stated that an analoguous loss of phospohorus in faeces did not depend on the consumed amount of phosphorus although few data were considered. Later it was established that the secretion of endogenous faecal phosporus could be changed directly by that consumed.

It is difficult to establish the smallest loss. ARC (1980) explained that the smallest loss was established if animals did not consume any phosphorus (consumption=0) at all. For sheep the determined value was 11.4 mg/day/kg body mass and for cattle 10.0 mg/day/kg body mass. These values were used in evaluation of requirements.

INRA (1978) concluded that the said values were useful only for animals which were fed primarily concentrates. Better estimation of loss was 25 mg/day/kg body mass for animals which were fed voluminous feedstuffs. Therefore the estimation of requirements was higher (Scott, 1986).

The efficiency of absorption of phosphorus is high. It is hard to verify the differences in consumption among various rations since animals absorb that element diversely. In experiments with animals of similar genotype it was found that phosphorus was absorbed from protein concetrates of plant origin and from cereals very effectively (0.80) but less effectively (0.64) from some grasses (Field et al., 1984, cit. by Scott, 1986).

Magnesium requirements of ruminants are less contradictory than calcium and phosphorus are. Magnesium is not absorbed from digestive tract as effectively as calcium and phosphorus are. That reason is not the insufficient utilisation of magnesium from a ration since the absorption of the element is connected to rumen where there are more systems that concur for it. Rumen microbes require a lot of magnesium. The pH in rumen accelarates the production of insoluble magnesium salts while the amount of magnesium for absorption is diminished again.

The content of potassium in a ration is also important. This negative effect is not connected to the utilisation itself but it affects the transporting system which regulates the absorption of magnesium through the rumen epithelium. Even high concentrations of ammonia in the rumen oppose the absorption of magnesium by acting on its transition through rumen wall on one or by rising the production of insoluble magnesium compositions on the other band (Scott, 1986).

Absorption of magnesium is low if sodium: potassium ratio in the rumen is low.

Sodium substances are known to be well soluble in water and their absorption from voluminous feedstuffs could be very high. In the case of sodium deficiency the sodium secretion with urine and faeces decreases significantly. The volume of urine increases and causes even lower concetrations of sodium in urine (Winson, 1990).

It can be concluded that the major element requirements of ruminants are connected to the kind of feedstuffs that make part of the ration and to the efficiency of utilization of elements from the ration.

The standards express the trend of decreasing requirements which is supreme from the point of view of environment protection. The cost of added minerals will be reduced as well.

CONCLUSION

Grass silage is an important factor in animal supply with potassium, calcium, phosphorus, magnesium and sodium.

The rate of mineral supply by silage depends on the ration composition which contains primarily voluminous feedstuffs or concentrates.

Grass sialge and raw material contain little sodium in comparison with the data from literature.

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SAŽETAK

Kmetijsko gospodarstvo Kočevje posjeduje oko 2000 ha travnjaka. Svake se godine pripremi oko 9000 t travne silaže. Zimski obroci za krave muzare imaju oko 30 kg travne silaže. Tovljenici dobivaju travnu silažu ad lib., do 20 kg na dan. Godine 1992. analizirano je 38 uzoraka travne silaže. Prosječni sadržaj suhe tvari (ST) bio je 333,5 g. kg^{-1}, a sirovog pepela 97,41 g. kg^{-1} ST. Prosječni sadržaj nekih osnovnih makroelemenata po kg ST bio je: 6,98 g. kalcija, 3,04 g fosfora, 2,23 g. magnezija, 18,22 g. kalija i 0,70 g. natrija. Uzevši u obzir prosječni sadržaj ST u silaži, životinje su trošile gore navedenu količinu elemenata u tri kg travne silaže.

TRAVNA SILAŽA KOT VIR MAKROELEMENTOV

IZVLEČEK

Kmetijsko gospodarstvo Kočevje ima okrog 2000 ha travnikov. Vsako leto pripravijo približno 9000 ton travne silaže. V zimskem obroku krav molznic je okrog 30 kg travne silaže. Pitanci zauživajo travno silažo po želji, do 20 kg na dan. V letu 1992 je bilo analiziranih 38 vzorcev travne silaže. Silaža je vsebovala povprečno 333,5 g suhe snovi (SS) kg^{-1} in 97,41 g surovega pepela kg^{-1} SS. Srednje vsebnosti nekaterih esencialnih makroelementov v kg SS so bile: kalcij 6,98 g; fosfor 3,04 g; magnezij 3,23 g; kalij 18,22 g in natrij 0,70 g. Glede na srednjo vrednost SS v silaži so živali zaužile navedene množine elementov s 3 kg travne silaže.