THE INFLUENCE OF ORGANIC AND MINERAL FERTILIZATION ON THE SODIUM, POTASSIUM, CALCIUM AND MAGNESIUM CONTENT IN THE FORAGES FROM A PERMANENT MEADOW (GRĂDINARI; CARAŞ-SEVERIN)

INFLUENȚA FERTILIZĂRII ORGANICE ŞI MINERALE ASUPRA CONȚINUTULUI ÎN SODIU, POTASIU, CALCIU ŞI MAGNEZIU DIN FURAJELE PROVENITE DE PE O PAJIŞTE PERMANENTĂ (GRĂDINARI; CARAŞ-SEVERIN)

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Abstract: *In this paper are presented our results regarding the influence of mineral and organic fertilization on the Na, K, Ca and Mg contents in forages harvested from a permanent meadow situated in a hill region of Banat County (Grădinari; Caraş-Severin). Mineral fertilizers used were NPK complex, ammonium nitrate, super phosphate and potassium salt. Fermented manure sheep was used like organic fertilizer. The mineral fertilization was made yearly, whereas the sheep manure was applied at each two years. The Na, K, Ca and Mg contents have been analyzed using flame atomic absorption spectrometry (FAAS). The correlations between analyzed minerals contents in forages and mineral or organic fertilizers are discussed. Both fertilizers influenced the Na, K, Ca and Mg contents of the forages, but in different manner.*

Rezumat: *În această lucrare sunt prezentate rezultatele cercetării noastre legate de influența fertilizării minerale şi organice asupra conținutului de Na, K, Ca şi Mg în furajele recoltate de pe o pajişte permanentă situată în zona de câmpie a Banatului (Grădinari; Caraş-Severin). Fertilizanții minerali utilizați au fost complexe NPK, azotat de amoniu, superfosfat şi sare potasică. Ca fertilizant organic s-a folosit gunoiul de ovine fermentat. Fertilizanții minerali au fost aplicați anual, în timp ce gunoiul de ovine o dată la doi ani. Conținutul în Na, K, Ca şi Mg a fost determinat prin spectrometrie de absorbție atomică în flacără (FAAS). S-au realizat apoi corelații între conținutul furajelor în mineralele analizate şi fertilizanții de natură minerală sau organică aplicați. Ambele tipuri de fertilizanți influențează conținutul în Na, K, Ca şi Mg al furajelor, însă în mod diferit.*

Key words: *minerals, mineral fertilization, organic fertilization, forages, permanent meadow.*
Cuvinte cheie: *minerale, fertilizare minerală, fertilizare organică, furaje, pajişte permanentă.*

INTRODUCTION

Macro-minerals are indispensable in animal organisms, because are responsible for tissues formation, water content and osmotic pressure regulations, specific enzymes activation [SOCACIU, 2003]. That's way it is important that the animals feed must contain macro elements in optimum quantities. Generally the forages from permanent meadows is rich in macro elements, but quantities are variables, depending on the species heterogeneity, the phonologic state, soil contents in nutritive elements and their accessibilities for the plants [VÎNTU, 2006].

The accessibility of metals for plants depends on soil reaction, soil humidity, microbiological activity, mineral colloids and organic matter content. The organic matter, especially humus compounds, can form organic-metallic compounds with high mobility in soil solutions and with high availability for plants [KABATA & PENDIAS, 2001].

The Na distribution is with predilection in extra cellular compartment [Gârban, 1999]. It is responsible for depolarization of cellular membrane and for the water equilibrium both in

intra- and extra cellular medium [MOGOS, 1997].

K is an element with an intracellular distribution. It was established that 98% from total content of K are inside the cell, and only 2% are extra-cellular [Pop, 2002]. K has many physiological rolls: assures the osmolarity of intracellular medium, increases the neuro-muscular excitability (heaving antagonist effect with Ca), is involving in digestion processes (is presenting in pancreatic and intestinal juices), favors the water elimination and influences the carbohydrates metabolism [GÂRBAN, 1999].

The Ca distribution point out that 98% of total content is in osseous system. In animal's organism Ca participates at neuromuscular excitability maintaining (with Mg), to blood coagulation processes, enzymes activation (lipase, phosphatase), at cellular membrane permeability control (antagonizing with sodium and potassium) [ARMSTRONG, 1989].

Mg is present in all animal tissues, appreciatively 25g, from which 65% in osseous system like phosphates, the rest being bound with muscular tissue proteins or in blood [Socaciu, 2003]. Mg is involving in carbohydrates, lipids and proteins metabolisms; participate with calcium and magnesium at resistance of osseous structure; is involving in nervous influx transmittance; activates immunoglobulin's synthesis, DNA and RNA polymerase [GÂRBAN, 1999].

The aim of this study was to determine the concentrations in Na, K, Ca and Mg of forages harvested in early spring from a permanent meadow situated near Gradinari (Caras-Severin District).

MATERIAL AND METHODS

The experimental field is a permanent meadow situated near Grădinari (Caraş-Severin District), in a hill region. It was for the first time fertilized in autumn of 2003. Mineral fertilizers used were NPK complex, ammonium nitrate, super phosphate and potassium salt. Fermented manure sheep was used like organic fertilizer. Permanent meadow was organized in ten experimental variants and five replicates for each variant, fertilized either with sheep manure only, or with sheep manure and NPK mineral fertilizers, or with NPK mineral fertilizers only. The experimental field included: V1 – untreated, V2 – 20 t/ha manure, V3 – 40 t/ha manure, V4 – 60 t/ha manure, V5 – 20 t/ha manure + 50 P2O5 (Kg/ha), V6 – 20 t/ha manure + 50 P2O5 (Kg/ha) + 50 K2O (Kg/ha), V7 - 20 t/ha manure + 50 P2O5 (Kg/ha) + 50 K2O (Kg/ha) + 50 N (Kg/ha), V8 = 100 N (Kg/ha) + 50 P2O5 (Kg/ha) + 50 K2O (Kg/ha), V9 = 150 N (Kg/ha) + 50 P2O5 (Kg/ha) + 50 K2O (Kg/ha), V10 = (100 + 100) N (Kg/ha) + 50 P2O5 (Kg/ha) + 50 K2O (Kg/ha). The mineral fertilization was made yearly, whereas the sheep manure was applied at each two years. The experience was located on a brown soil argiloiluvial, in a region with 10.5^{o}C annual average temperature.

The main plants in analyzed forages samples, harvested in early spring of 2008, were *Festuca rupicola* and *Calamagrostis epigeios*. From the other botanical families there were: *Antohoxanthum odoratum*, *Briza media*, *Poa pratensis*, *Trifolium arvense*, *Trifolium medium*, *Genista tinctoria*, *Lotus corniculatus* and *Filipendula vulgaris*.

The Na, K, Ca and Mg content from forages samples were determined after dry burning of 10 g samples in quartz capsules at 550^{o}C for 4 hours. After complete burning, resulted ash was dissolved with 10 mL HNO_3 0.5N, evaporated on sand bath and residue was dissolved with nitric acid 0.5 N solution up to 50 mL. The solutions obtained were used for Na, K, Ca and Mg content determination by flame atomic absorption spectrometry (F-AAS). The standard solutions (1000 mg/L) used to obtain the calibration curves had analytical grade and was purchased from Riedel de Haen (Germany). The nitric acid 65% solution used was of ultra pure grade (Merck, Germany). All metals have been analyzed using Flame Atomic Absorption Spectrometry (FAAS), by ContrAA-300, AnalytikJena device, in air/acetylene flame.

Acetylene was of 99.99 % purity. The correlation coefficient for the calibration curves (R^2) ranged between 0.9745 - 0.9891. All analyses were made in triplicate and the mean values were reported.

The obtained results for metals contents were interpreted with Principal Components and Classification Analysis implemented in Statistical 6 package Software.

RESULTS AND DISCUSSIONS

The correlations between alkaline and earth-alkaline minerals content of forages and mineral and organic fertilizers are presented in Table 1 and in Figure 1:

Table 1.

Matrix correlation between alkaline and earth-alkaline minerals content of forages and mineral and organic fertilizers

Influence factors / metals	Ca	Mg	K	Na
N mineral fertilizer	-0.70*	-0.31	0.54	-0.25
P mineral fertilizer	-0.48	-0.46	0.50	-0.68*
K mineral fertilizer	-0.43	-0.29	0.49	-0.50
Manure (organic fertilizer)	0.59	0.60	0.12	-0.07

- Significant correlation at p <0.05

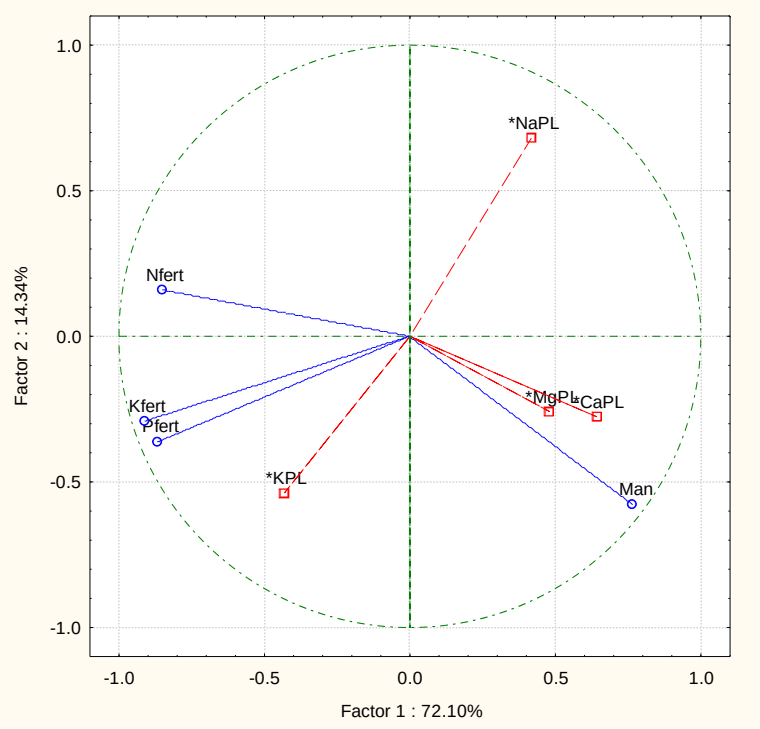

Figure 1. The effect of mineral and organic fertilizers on the Na, K, Ca and Mg contents in forages

It is possible to observe that mineral fertilization has a negative influence on the Ca content of forages, the correlation coefficient being r=-0.48 for P_2O_5 mineral fertilizer, r=-0.43 for K_2O mineral fertilizer and significant statistically at p <0.05 for N mineral fertilizer (r=-0.70). On the other hand the organic fertilizations with sheep manure influence positively the Ca content of forages, r=0.59.

Mg content of forges, like Ca, is influenced negatively by mineral fertilizer application, r=-0.31 for N mineral fertilizer, r=-0.46 for P_2O_5 mineral fertilizer and r=-0.29 for K_2O mineral fertilizer, while organic fertilizer has a positive effect, r=0.60.

A possible explanation can be that for Ca and Mg were obtained also negative correlation coefficients between soil content and the mineral fertilizers and positively for manure application case. That means the mineral fertilizers carries out Ca and Mg from superior soil horizon, while sheep manure improve the Ca and Mg content in soil [Harmanescu et al, 2008].

Between K content of forages and both types of fertilizers were obtained positively correlation: r=0.54 for N mineral fertilizer, r=0.50 for P_2O_5 mineral fertilizer, r=0.49 for K_2O mineral fertilizer and r=0.12 for sheep manure.

For Na content of forages the mineral fertilizers have negative effects: r=-0.25 for N mineral fertilizer, r=-0.68 for P_2O_5 mineral fertilizer and r=-0.50 for K_2O mineral fertilizer. Organic fertilization didn't influence the forages Na content.

CONCLUSIONS

Mineral or organic fertilization of permanent pasture have different effect on the macro-elements contents from forages. Mineral fertilizers lower the Ca, Mg and Na forages contents. On the other hand the organic fertilization with sheep manure improves the Ca and Mg contents of forages. Between K content of forages and both types of fertilizers were obtained positively correlation.

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