CALCIUM AND MAGNESIUM CONTENT IN TURFGRASS INFLUENCED BY MIXTURE TYPE AND FERTILIZATION

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Abstract

Fertilization of turfgrasses is an important maintenance activity that influences the vigor and health of the grass plants. Different types of fertilizers can be used for different purposes. Nitrogen based fertilizers with both slow release and fast release nitrogen are the choice of managers who want to stimulate shoot growth and colour. Other fertilizers have different combination of macro and microelements such as potassium, phosphorus, calcium, magnezium, iron, sulfur and so on. The choice of fertilizer is influenced mainly by rootzone but also by turfgrass functionality and the intensity of management. In our study were analyzed the calcium and magnesium content in plant tissue in relation with differentiated fertilization on three different turf mixtures under the influence of the pedoclimatic conditions in the NE region of Romania. The first mixture (M1) was composed of *Festuca arundinacea* 80% + *Lolium perenne* 10% + *Poa pratensis* 10%. The second mixture (M2) consisted of three varieties of *Lolium perenne* mixed in equal proportions. The third mixture (M3) was composed of *Festuca rubra* 60% + *Lolium perenne* 20% + *Festuca ovina duriusculla* 10% + *Poa pratensis* 10%. Three types of fertilizers were applied: ammonium nitrate, a complex fertilizer with nitrogen and phosphorus and a commercial lawn fertilizer with macro and micronutrients. The experimental design was a split plot design with three replicates. Statistical interpretation of the data was done by analyzes of variance and limit differences.

Key words: calcium and magnezium content in plant tissue; turfgrass quality; turfgrass mixtures

Fertilization of turfgrasses is an important maintenance activity that influences the vigor and health of the grass plants. (Christians N., 2004). Different types of fertilizers can be used for different purposes. Nitrogen based fertilizers with both slow release and fast release nitrogen are the choice of managers who want to stimulate shoot growth and colour (Soldat D.J., 2008). Other fertilizers have different combination od macro and microelements such as potassium, phosphorus, calcium, magnezium, iron, sulfur and so on (Miller, N.A ., 2012). The choice of fertilizer is influenced mainly by rootzone but also by turfgrass functionality and the intensity of management (Kellner E., 1974). Macronutrients are represented by those elements consumed in large quantities by perennial grasses which are found in high concentrations in plant tissue (Danneberger K., 1993; Rowland J.H., 2010; Varco J., 1984). These macroelements are absorbed in plants through the root system: nitrogen, phosphorus, potassium, calcium, magnezium and sulfur or can be taken from the atmosphere: carbon, oxygen.

Magnesium is found in the central structure of the clorophyll and in the structure of proteins that are spread in all green parts of grasses. (Dunn J. H., Diesburg K., 2004).

The aim of this study is to determine the relation between calcium and magnesium content in turfgrass plants in relation with turfgrass species and fertilizer type.

MATERIAL AND METHOD

The biological material consisted of three mixtures of cool season perennial grasses. The first mixture (M1) was composed by *Festuca arundinacea* 80% + *Lolium perenne* 10% + *Poa pratensis*10%. The second mixture (M2) consisted of three varieties of *Lolium perenne* mixed in equal proportions.

The third mixture (M3) was composed of *Festuca rubra* 60% + *Lolium perenne* 20% + *Festuca ovina duriusculla* 10% + *Poa pratensis* 10%.

Three types of fertilizers were applied: ammonium nitrate, a complex fertilizer with nitrogen and phosphorus and a commercial lawn fertilizer with macro and micronutrients. All three fertilizers were applied at a nitrogen rate of 75 kg ha^{-1}. The experimental design was a split plot design with three replicates. The area of a plot was

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8 square meters (2m x 4m), and the sub-plot area was 2 square meters (1m x 2m). Field sampling of green tissue was done in the year 2011, samples were dried and grinded into powder and magnesium and calcium content was determined using mass absorbtion spectrophotometry method. The data were interpreted statistically by analysis of variance and limit differences.

Table 1.

Magnesium content in turfgrass % DM in 2011

Mixture type	Control	N75	N75 P45	N75 P45 K72 + Ca18 Mg15 S144 + ME (Fe, Zn, B, Mn, Mo)
M1	0.27	0.25	0.25	0.33
M2	0.32	0.30	0.36	0.32
M3	0.35	0.34	0.32	0.29

Table 2

The influence of fertilization on magnesium content (%) DM

Fertilization	Magnesium (%) DM
Control	0.31
N75	0.30
N75 P45	0.31
N75 P45 K72 + Ca18 Mg15 S144 + ME (Fe, Zn, B, Mn, Mo)	0.31

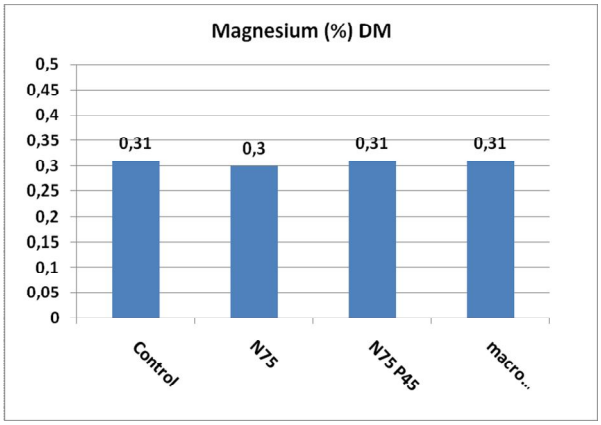

Figure 1 **Magnesium content under fertilization**

RESULTS AND DISCUSSION

The mean annual temperature in the area is 9.6°C and the annual rainfall is 518 mm, with drought occuring in September. Magnesium content in turfgrass plants ranged between acceptable limits both under the influence of fertilization and in the absence of it. If the variation induced by different fertilizers used was quite low, the difference between mixtures were higher explained by the variation of plant species among mixtures. The lowest content was observed at the M1-drought type mixture based on tall fescue (*Festuca arundinacea* Schreb.) which ranged between 0.25% DM at nitrogen fertilization to 0.33% DM at complex fertilization. M2-sports type mixture (*Lolium perenne* L.) had little variation between 0.30% DM to 0.36% DM. On site soil conditions determined a little influence on magnesium content in plants due to different fertilization scheme used since magnesium content variated very little (fig. 1) under the influence of fertilization from 0.30% DM in the N_{75} variant to 0.31% DM determined in all fertilization treatments. Among species the differences were higher (fig. 2), ranged between 0.27% DM at tall fescue mixture, 0.32% DM at perennial ryegrass mixture and 0.33% DM at fine fescue mixture (M3-ornamental type). This is explained by the characteristics of the fertile soil with medium soil texture where additional application of magnesium is not necessary to turfgrasses, and the difference of grass species in the absorbtion process of magnesium.

Table 3

The influence of mixture type on magnesium content (%) DM

Mixture type	Magnesium (%) DM
M1	0.27
M2	0.32
M3	0.33

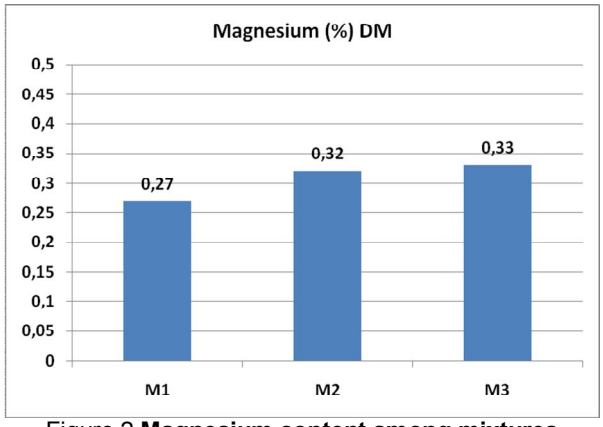

Figure 2 **Magnesium content among mixtures**

Table 4

Calcium content in turfgrass (%) DM in 2011

Mixture type	Control	N75	N75 P45	N75 P45 K72 + Ca18 Mg15 S144 + ME (Fe, Zn, B, Mn, Mo)
M1	0.76	2.14	1.67	1.48
M2	1.12	1.39	1.93	1.91
M3	1.73	1.21	1.23	1.45

Table 5

The influence of mixture type on calcium content (%) DM

Mixture type	Calcium (%) DM
M1	1.51
M2	1.59
M3	1.40

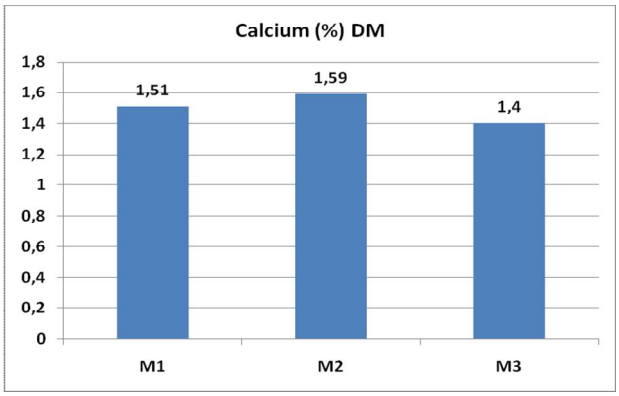

Figure 3 **Caclium content among mixtures**

Table 6

The influence of fertilization on calcium content (%) DM

Fertilization	Calcium (%) DM
Control	1.20
N75	1.58
N75 P45	1.61
N75 P45 K72 + Ca18 Mg15 S144 + ME (Fe, Zn, B, Mn, Mo)	1.60

Calcium absorbtion in turfgrass was deeply influenced by fertilization. The content of calcium increased from 1.20% DM to 1.61% DM at the fertilization treatment which included both nitrogen and phosphorus. Fertilized plots were more able to extract calcium from the soil as they were more developed both above and underground. However we observed little difference between fertilizers (fig. 4) since the complex fertilizer which included calcium as a fertilization input did not produce a higher calcium content in plants compared with fertilzers where calcium was absent, such as ammonium nitrate or $N_{75}P_{45}$.

Within mixtures also were differences (fig. 3), as sports type mixture M2 and drought type mixture M1 had higher concentration of calcium, compared with fine fescue based ornamental type mixture M3 which had the lowest. M1 mixture had a calcium content of 1.51% DM, M2 mixture had 1.59% DM while M3 mixture had 1.40% DM. the lowest calcium absorbtion was observed at control plot in the case of both M1 and M2 mixture where calcium content increased gradually as fertilization was applied. This is not the case with M3 mixture where the calcium content was higher at unfertilized control plot (1.73% DM) which then dropped at 1.21% DM at ammonium nitrate fertilization, 1.21% DM at $N_{75}P_{45}$ fertilization and 1.45% DM at complex macro and micronutrient fertilization.

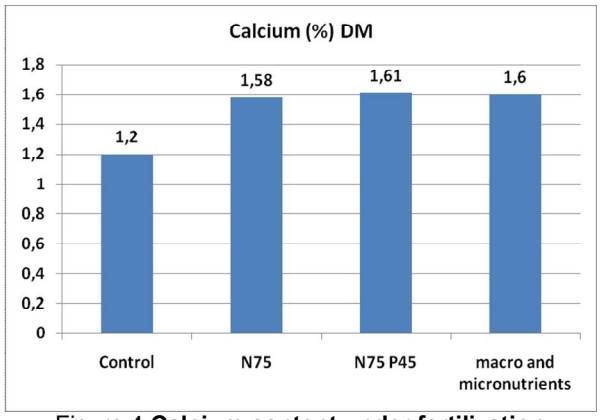

Figure 4 **Calcium content under fertilization**

CONCLUSIONS

The highest concentration of magnesium in turfgrass plant tissue was observed at M3 ornamental type mixture based on *Festuca rubra*.

Magnesium content in turfgrass plants ranged between acceptable limits both under the influence of fertilization and in the absence of it.

On site soil conditions determined a little influence by fertilization on magnesium content in plants, explained by the characteristics of the fertile soil with medium soil texture where additional application of magnesium is not necessary to turfgrasses.

Calcium absorbtion in turfgrass was deeply influenced by fertilization. The content of calcium increased from 1.20% DM to 1.61% DM at the fertilization treatment which included both nitrogen and phosphorus.

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