Establishment of Variations in Mycorrhizal Colonization Produced by Overlapping a Treatment with Zinc Sulphate over Differentiated Fertilization

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Abstract

More accentuated intensification of management from areas with high biodiversity may act to reduce the level of mycorrhizal colonization, while producing a reduction in plant resistance to stress factors. In the context of current climate drought is an common phenomenon, and depreciation of hyphal networks produced by mycorrhizae in root systems of plants increases their susceptibility to drought. In these circumstances, application of zinc over fertilization can increase the mycorrhizal colonization with increasing plant resistance to drought. The main objective of this paper was to analyze the potential for stabilization of colonization based on zinc application as a base for grassland ecosystems balance preservation under changes in the way of fertilization applied to these surfaces. The level of colonization was analysed in roots of *Festuca rubra*, during 2010-2011, samples being collected from an experiment with 6 graduations of mineral and organic fertilization located in Garda de Sus village, on each variant being additionally applied a zinc sulphate treatment. Application of zinc sulphate over fertilization with manure acts to reduce the level of frequency of colonization in the root system of plants of *Festuca rubra*, at the end of the growing season. At the same sampling period, a similar phenomenon is recorded under conditions of Eurofertil mezocalc fertilization. The intensity of the colonization varies greatly under the experimental conditions, higher values were observed at the end of the growing season for fertilization based on chemical nitrogen. During the period of plant maximum activity successful fertilizer recipes were without chemical nitrogen supplements in 2010, and NPK fertilization in 2011, these options ensuring the highest levels of colonization intensity.

Keywords: *climatic stresses, fertilization, zinc sulphate, mycorrhizal colonization*

Introduction. Mycorrhizas are symbiotic fungi with the roots of higher plants, which along evolution have developed the ability to produce intra- and extraradicular hyphal networks, involved in the absorption and transfer of nutrient solutions to their associated plants (Johnson, 2010). Intensification, more and more accentuated, of fertilization applied to areas rich in biodiversity can act to reduce the level of mycorrhizal colonization in the root systems of plants, which over time can lead to a decrease in plant resistance to stress factors. In the context of the current climate, drought is a common phenomenon, and depreciation of extraradicular hyphal networks decreases the potential of fungi to absorb water

and nutrients, which increases the susceptibility of plants to drought. In these circumstances, application of zinc over fertilization is a potential solution to this disrupting phenomenon, increasing the mycorrhizal colonization and providing a better plant resistance to drought (Watts-Williams *et al.*, 2014).

Aims and objectives. The study focuses on assessing the potential for stabilization of mycorrhizal colonization following application of zinc-based substances as a solution to the conservation of grassland ecosystems equilibrium in terms of differentiated fertilization.

Materials and methods. Colonization data were obtained from an experimental field located

Tab. 1. The variation on vegetation sequences of the colonization parameters produced by overlapping zinc sulphate over fertilizer recipe

	Variant	S2						
		cdeg %	V1	V2	V3	V4	V5	V6
S1	V1	10.69	0.922	0.001 ***	0.330	0.629	0.001 ***	0.002 **
	V2	6.93	0.262	0.031 *	0.804	0.091	0.001 ***	0.053
	V3	8.00	0.437	0.013 *	0.920	0.177	0.001 ***	0.024 *
	V4	9.08	0.669	0.005 **	0.652	0.314	0.001 ***	0.010 **
	V5	5.69	0.129	0.075	0.515	0.038 *	0.001 ***	0.122
	V6	9.01	0.653	0.005 **	0.667	0.304	0.001 ***	0.010 **

Note: Number of * denote significant differences (LSD test, $p < 0.05$, $p < 0.01$, $p < 0.001$).

in Ghețari village, Romania, zinc sulfate being applied over 6 types of fertilization. *Festuca rubra* roots collection took place in two sequences of vegetation, 100 days (S1) and 150 days (S2) from the vegetation starting point. Graduation of fertilization include an unfertilized variant (V1), two variants fertilized with manure (V2 - 10 t / ha and V3 - 10 t / ha + 50 kg/ha+N₂) and three variants of mineral fertilization (V4 - NPK 50:25:25 kg/ha, V5 - Eurofertil mezocalc 120 kg/ha+50 kg/ha N₂, V6 - Eurofertil mezocalc 120 kg/ha). Mycorrhizal colonization parameter analyzed in this paper is the degree of colonization (cdeg%), synthetic index obtained from the frequency and intensity of colonization of the root system, providing a complex image of the expansion of intraradicular hyphal network during the period of maximum (S1) and end of vegetation (S2).

Results and Discussion.

The application of zinc sulphate in addition to the fertilizer recipe creates strong variations in the degree of colonization of the two sequences recorded at the level growing season (Tab. 1). At control variant and the variants fertilized with manure supplemented with mineral nitrogen (V3) and NPK (V4) zinc acted to limit the variations of colonization, registered differences were insignificant. In contrast, at the variants containing Eurofertil mezocalc in the recipes fertilization were produced abrupt changes in the values of the degree of colonization, at the V5 variant parameter

value increased from 5.69%, in the first sequence of vegetation, up to 21.85% (S2), simultaneously with the decrease of the parameter at V6 from 9.01% (S1) to 0.9 (S2).

For the first sequence of vegetation, the highest degree of colonization was recorded in unfertilized variant (V1), followed closely by the values obtained from fertilizations V4 and V6, at the second sequence of vegetation was noted variant fertilized with Eurofertil mezocalc supplemented with mineral nitrogen (V5), all the other variants recording values of at least twice lower.

Conclusion. Applying a treatment with zinc sulphate over fertilization can provide balanced levels of mycorrhizal colonization, aspect that can be used for maintaining stability of plants in grassland ecosystems, in terms of increasing their resistance to climatic stresses.

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