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Influence of Some Ecological Factors on the Number of Soil Actinomycetes in Different Physiological Phases of Development of Maize

Ljubica ŠARČEVIĆ-TODOSIJEVIĆ[1*], Vera POPOVIĆ[2], Snežana ĐORĐEVIĆ[3], Ljubiša ŽIVANOVIĆ[4], Vladimir FILIPOVIĆ[5], Nikola ĐORĐEVIĆ[3], Jelena Golijan[4]

[1]High Medical - sanitary School of Professional Studies "Visan", Tošin bunar, 7a, Zemun, Belgrade, SERBIA; [2]Institute of Field and Vegetable Crops, Maksim Gorki 30, Novi Sad, SERBIA; [3]Biounik, Krnješevačka, bb, Belgrade, SERBIA; [4]University of Belgrade, Faculty of Agriculture, Nemanjina 6, Zemun, Belgrade, SERBIA; [5]Institute of Medicinal Plant "Dr. Josif Pančić", Belgrade, SERBIA; *Correspondence: ljsarcevic@gmail.com;

Introduction

Maize (*Zea mays* L.) is one of the biggest profits in 20th-century agriculture. Strategically, it is important agricultural species that occupies the third place in the world's widespread distribution (143 mil. ha), after wheat (215 mil.ha) and rice (151 mil. ha) (Božović et al., 2018). On successful production affect in addition to genotype, abiotic factors and biotic factors. Microorganisms are the most important factor in forming of soil fertility. The number and enzyme activity stand for the current state of microbiological soil activity (Šarčević et al., 2016).

Material and Methods

In this paper, the influence of environmental factors on the number of actinomycetes in the soil type "cernozem", at different physiological stages of maize development, was determined. During vegetation period, optimal cultivation technology was applied.

The examinations covered the following systems of maize fertilization:

1 - Control (without fertilizer);
2 - $P_{90}K_{60}N_{30}$ kg ha^{-1} (basis, phon);
3 - $P_{90}K_{60}N_{60}$ kg ha^{-1};
4 - $P_{90}K_{60}N_{120}$ kg ha^{-1};
5 - $P_{90}K_{60}N_{180}$ kg ha^{-1}.

The number of actinomycetes (10^{-4}g^{-1}) was determined by the standard indirect method of sowing diluted soil samples on a selective nutrient medium starch-ammonia agar, and the sown samples were then incubated at 28^{0}C.

Table 1. Chemical features of carbon "cernozem" (Zemun Polje)

Depth (cm)	pH		Humus (%)	Nitrogen (%)	C/N	$CaCO_3$ (%)	mg /100 g	
	H_2O	n/1KCl					P_2O_5	K_2O
0 - 30	7.71	7.34	2.86	0.19	8.6:1	4.40	25.40	22.20
30 - 60	7.81	7.48	2.47	0.17	8.6:1	11.60	17.10	18.40
60 - 90	7.87	7.66	1.11	0.08	8.4:1	24.10	2.70	7.00

Results and discussion

Microorganisms that participate in the processes of soil matter circulation, encompass representatives of different ecophysiological groups and are a very significant indicator of soil fertility. Among the microorganisms mentioned are actinomycetes, which are phylogenetically belonging to the group of Gram - positive bacteria, and ecologically represent aerobic organotrophs groups of microorganisms. Forms with developed mycelium have a structure similar to eukaryotic fungi, but in the soil live simple forms of actinomycetes, which do not produce mycelium, and develop in the form of microcolonies. Although they represent soil microorganisms, which primarily participate in the processes of soil matter circulation, some types of soil actinomycetes also possess pathogenic properties.

Table 2. The number of actinomycetes in the soil depending on the phenophase of the plant, "ugar" or crop and the amount of N fertilizer (10^4 g^{-1})

A	C	B		$\bar{x}$
TIME	N (fertilizer)	„Ugar"	Under crop	
Phenophase of maize flowering	1.	10.8	8.0	9.4
	2.	12.3	4.0	8.15
	3.	8.4	10.4	9.4
	4.	14.6	13.5	14.05
	5.	9.0	7.8	8.4
		11.02	8.74	9.88
Phenophase of plant maturation	1.	13.9	12.9	13.4
	2.	10.0	21.0	15.5
	3.	14.4	14.3	14.35
	4.	18.5	17.2	17.85
	5.	15.9	9.0	12.45
		14.54	14.88	14.71

		A	C	ABC
L S D	0,05	1,43	2,27	3,21
	0,01	1,92	3,03	4,29

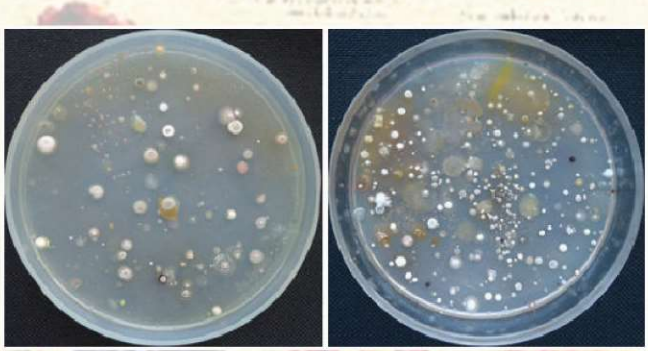

Figure 1. Actinomycete colonies from soils (Kekuda et al., 2015)

The phenophase of the plant significantly affected the number of actinomycetes in the time period of the research, in which it is more pronounced in the phenophase of plant maturation compared to the phenophase of maize flowering. Although actinomycetes belong to the group of drought-resistant microorganisms (Madigan et al., 1997), higher precipitation and an increase in soil moisture in the phenophase of plant maturation, caused actinomycetes to proliferate. The number of actinomycetes in the phenophase of maize flowering was higher on "ugar" compared to the crop, while in the phase of physiological maturity of the plant, the difference was not statistically significant.

The number of actinomycetes was significantly affected by the applied fertilizers. The applied amounts of fertilizers mainly increased the number of this group of microorganisms. A similar trend was observed in the phenophase of flowering and phenophase of plant ripening, on "ugar" and under crops.

In the phenophase of maize flowering, the highest number of actinomycetes, both on "ugar" (14.6 x 10^4g^{-1}) and under crop (13.5 x 10^4g^{-1}), was determined in the variant where N_{120} kg ha^{-1} was applied. The amount of nitrogen N_{180} kg ha^{-1} very significantly reduced the number of actinomycetes compared to this maximum number, but compared to the control, the differences are not significant.

Conclusion

According to the conducted research, it can be concluded that on the soil of "cernozem" type and in the climate conditions of Eastern Srem, a proper nitrogen nutrition applied on the examined number of actinomycetes (10^{-4}g^{-1}) , implies the use of 120 kgha^{-1} N, on a fon 90 kgha^{-1} of phosphorus and 60 kgha^{-1} of potassium. The number of actinomycetes in the phenophase of maize flowering was higher on "ugar" compared to the crop. In the phase of physiological maturity of the plant, the difference was not statistically significant.

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