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THE ROLE OF MICROORGANISMS IN AGROECOSYSTEMS

ULOGA MIKROORGANIZAMA U AGROEKOSISTEMIMA

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ABSTRACT

Due to knowledge that intensive agriculture has long-term effects on the ecosystem, deterioration in the quality of food is increasingly endangering the health of the human population.

The concept of sustainable agriculture includes production management system that promotes the recovery of ecosystems including biological cycles. The central place of these measures is given to microorganisms. The application of microorganisms as biofertilizers can be increased overall biological value which is a prerequisite for the preservation of the productive potential. By entering different groups of microorganisms in the soil increases the dynamics of the total number of microorganisms. Reducing the number and enzymatic activity of microorganisms in the soil when introducing contaminants such herbicides are the best indicator of its degradation.

KEY WORDS

Sustainable agriculture, biofertilizers, bioindicators, soil

APSTRAKT

S obzirom na činjenicu da intezivna poljoprivreda ima dugoročne efekte na ekosistem, opadanje kvaliteta hrane u velikoj meri utiče na zdravlje ljudske populacije.

Koncept održive poljoprivrede uključuje sistem proizvodnog menadžmenta koji promoviše oporavak ekosistema uključujući biološke cikluse. Centralno mesto ovih mera jesu mikroorganizmi. Primenom mikroorganizama kao biofertilizatora može biti povećana ukupna biološka vrednost koja je preduslov za očuvanje proizvodnog potencijala. Uvođenjem različitih grupa mikroorganizama u zemlji se povećava dinamika ukupnog broja mikroorganizama. Smanjenje broja enzimske aktivnosti mikroorganizama u zemljištu, kada se unesu zagađivači kao što su herbicidi su najbolji indikator degradacije.

KLJUČNE REČI

Održiva poljošprivreda, biofertilizatori, bioindikatori, zemljište

1. INTRODUCTION

Agroecosystem is part degraded natural ecosystems to which the most important activities taking place in food production. Through crop production man meets the needs for food, fiber and other products, and raw materials for the processing industry. According to FAO data in the world is treated only 10% of the total

area of which only 3% of high productivity. On the other hand there is a huge demographic pressure on agroecosystem because it is increasingly difficult to provide enough food for the growing population. With the increasing number of people are increasingly difficult to balance economic objectives and preserve the basic natural resources (Milanović et al. 2008). The rate of increase in food production is 3% and 2.5% of the population, but it can be said that the increase in food production, accompanied by an increase population(Kovačević 2011). However, according to FAO 1/3 of humanity now suffering from malnutrition due to various manipulations with the prices, placements and poor quality food. Therefore, from the appearance of the "green revolution" in food production to introduce new varieties and hybrids, which require the use of large quantities of chemical agents in order to achieve an increase in yield and economic benefits per unit area.Thus, agricultural production became partly technological production, which negatively affects the basic resources of food production and large production of gases that contribute to climate change. The biggest problems have arisen in the land degradation by reducing its fertility. It was found that the last decade has been a reduction in the share of humus in soils of an average of 0.38% (Bogdanović et al., 1983), leading to a risk of content humus for the production of safe and quality food. Having in mind that the land is the basis of survival of the living world, and that arable land is limited, it is not surprising that the quality of land in the focus of attention of the whole world, because the quality of the food depends on the quality of land (Cvijanović et al., 2013).

Soil quality in agro depends on the amount of organic matter and diversity of microbial populations in the soil. Microorganisms are the most numerous group of organisms in the soil under the direct influence of all substances that are introduced into the soil. Microorganisms of soil involved in the degradation of organic and inorganic compounds, in the immobilization of heavy metals, in the biodegradation of slowly degradable compounds such as polycyclic aromatic compounds (PAH), as well as in the processes that are related to an increase in the quality and fertility of the soil. Their enzymatic activity, abundance and diversity are bioindicators of the toxic effect of polluting substances into the soil. Because of its specificity can be used as biosensors toxicity land (Milosevic et al., 2008, Vajasari 2005). Also, some groups of microorganisms can be used in plant nutrition as a replacement or supplement to mineral fertilizers. Therefore, the aim of the paper is set to analyze the role of microorganisms in the agroecosystem as biofertilizers and the decomposition of the herbicide.

Therefore, the aim of the paper is set to analyze the role of microorganisms in the agroecosystem as biofertilizers and the decomposition of the herbicide.

2. SURVEY RESULTS

2.1. The application of beneficial and effective microorganisms as biofertilizers

Food plants is directly dependent on the amount and type of fertilizer. The intensive production of fertilizers affect 50-60% on yields of cultivated plants. However, large amounts of nitrogen fertilizers particularly negative effect on some soil properties and its biological value. Decades of use of mineral fertilizers is acidified soil which results in changes in microbial composition. These negative changes lead to changes in the composition of microbial communities in the soil, which can be very negative in the processes of synthesis of humic substances. Therefore, from the 1990s into the world and in our country there is a growing interest in finding possibilities of using microorganisms as a supplement or replacement of mineral nitrogen fertilizers, in order to avoid the adverse effects of mineral fertilizers. Microorganisms biofertilizers are different and can be symbiotic, associative or mulitipni inocula in which there is a mixture of different types of microorganisms isolated from natural habitats. Application of symbiotic biofertilizers in the cultivation of soybeans, today it has become a mandatory measure, especially for the land on which previously did not raise soybeans. The symbiotic biological nitrogen fixation provides about 55% of the total amount of nitrogen that plants made available, and this measure has an extraordinary economic and ecological importance. According to research Marinković et al. (2010) in terms of soybean production with 30 kg.ha-1 and symbiotic bacterium Bradyrhizobium japonica parameters generated higher yields of plants, while research Agha et al., (2000) show that in the fertilization with 50 kg.ha-1 of mineral nitrogen a larger number of pods and number of seeds per plant.

Besides the the group of symbiotic microorganisms have great significance associative groups of microorganisms that fix atmospheric nitrogen. This group includes genera such as Azotobacter, Azospirillum, Derxia, etc., which can be used as inoculum of seed in the production of major field crops of wheat, corn, sugar beet, sunflower seeds and some vegetable crops. In such Association it is possible to replace up to 60 kgN.ha-1, and even those levels may be up to 150 kgN.ha-1. However, what is very important to their introduction into the soil activates the indigenous microbial population, increase the amount of available nutrients for the plants, then the biomass of microbes, enhancing the processes of humification, improves soil structure, which contributes to the increase of its fertility and quality production. By entering these inoculum in the soil of a group of microorganisms are stimulated to grow, some inhibited, while in some there is no change in the number Schwieger and Tebbe (2000), Bacilio-Jimenez et al. (2001).

The research results of inoculation of maize seed FAO 600 with individual associative type Azotobacter chroococcum, Azotobacter vinelandiand their mixture with humic acids are given in Table 1. Application of inoculum at different levels of fertilization affected the increase in the total number of microorganisms in the rhizosphere soil of 98.11% in compared to the version without the application of fertilizer before seeding. The greatest dynamics of the total number of microorganisms (an increase of 146.56%) was in doses of fertilizer than 90 kgN.ha-1. In relation to the surrounding land (126.15 .10-7.g soil) observed in the rhizosphere larger numbers (227.47 .10-7.g soil) of total microorganisms. The dynamics of the number of microorganisms was not statistically significant at $p < 0.01$.

The results were correlated with results Hajnal et al., (2006) who in their study found a statistically significant increase in the total number of microorganisms and seed yield of corn seed inoculation with a mixture of associative groups and nitrogen-fixing cyanobacteria Anabaena and Nostoc.

Table 1. The effect of the application of associative nitrogen-fixing and mineral nitrogen on the dynamics of changes total abundance of microorganisms (10-7.g soil) in the rhizosphere soil type in maize (Cvijanović G. 2002.)

kg N ha^{-1}(A)	Rhizosphere (B)	Index Level		Soil in row (B)	Index Level
0	114,82	100,00		47,08	100,00
60	283,11	246,56		143,56	304,92
80	251,43	218,97		164,13	348,61
120	260,55	226,92		149,83	318,24
Average	227,47	198,11		126,15	267,94
	A	B	AxB	C	AxC
F test	4,778**	1242,52**	1,738	665,46**	13,004**
$LSD_{0,05}$	6,881	-	-	-	18,40
$LSD_{0,01}$	9,147	-	-	-	24,47

Table 2 shows the results of the dynamics of the total number of microorganisms in the inoculation of wheat. Before sowing the seeds inoculated wheat variety Pobeda. During the vegetation in the tillering stage was applied foliar treatment with Azotobacter chroococcum, Azospirillum lipoferum, Brijerinckia Derx, Klebsiella planticola. The total number of microorganisms was increased by 60.37%, while the surrounding land increase was 79.10%, which was statistically significant at $p < 0.01$.

Table 2.The effect of the application of associative nitrogen-fixing and mineral nitrogen on the dynamics of changes total abundance of microorganisms (10^{-7}.g soil) in the rhizosphere soil type in wheat(Cvijanović G. 2002.)

kg N ha^{-1}(A)	Rhizosphere (B)	Index Level		Soil in row (B)	Index Level
0	94,04	100,00		32,20	100,00
60	170,11	180,89		46,70	145,03
80	170,34	181,13		75,54	234,59
120	168,79	179,48		76,25	236,80
Average	150,82	160,37		57,67	179,10
	A	B	AxB	C	AxC
F test	16,881**	485,896**	2,654	135,764**	4,979
$LSD_{0,05}$	9,194	-	-	-	-
$LSD_{0,01}$	12,170	-	-	-	-

Advantages of using this form of crop production is that in this way the land is enriched in organic matter, and also activates indigenous microbial population and accelerate redox processes in the soil, which affects the yield and quality of cultivated plants. On basis of research shows that the dynamics of the number of microorganisms varied inversely in proportion by quantity of mineral nitrogen, but it can be concluded that high doses of fertilizers negatively affect the microbial activity in the soil.

The need for application of biofertilizers in sustainable crop production, in recent years more and more studies are represented by the application of effective groups of microorganisms isolated from natural habitat as multiple inocula. According to Higa (1991) effective microorganisms contain previously selected species of microorganisms including dominant population of bacteria, actinomycetes, fungi and others. All applied types or strains must be compatible in liquid culture which is used as inoculum. Application of inoculum with a funny species or strains of the same species, it is difficult to determine the influence of individual strains or species. If such inocula based on the principles of natural ecosystems, or the number and effectiveness have higher starting position of the indigenous population, then their effectiveness will be great. Advantages of such multiple inoculant is multiple, keeps the level of soil fertility, increase immunity of plants, plants have an intense increase in the initial stages of development, increases the yield and dry matter content in the fruits.

Based on research conducted by using effective microorganisms (EM) in multiple inocula in soil treatment before planting and growing plants in 2014-2015. year established an increase in the total number of microorganisms in the rhizosphere of maize hybrids ZP 560 and NS 4030. In multiple inoculum was a mixture of different groups of microorganisms and effective strains of *Lactobacillus plantarum, Lactobacillus casei, Streptococcus lactis, Rhodopseudomonas palustris, Rodobacter sphaeroides, carevisiae Saccharomyces, Candida utilis, Streptomyces albus, Streptomyces griseus, Aspergillus oryzae, Mucor hiemali.*

On the part of the of the research experiments with mineral fertilizers NPK 15:15:15 is applied 150 kg.ha^{-1} and before seeding UREA 46% of 100 kg.ha^{-1}, a part of the plot, in the autumn manure was applied in an amount of 30 t.ha^{-1}. Increased number of microorganisms in rhizosphere of both hybrids was determined by fertilization with the application of organic fertilizer with and without the application of effective microorganisms. The application of effective microorganisms caused the increase in the total number of microorganisms in both hybrids. When using mineral fertilizer percentage increase was higher 49.70% than the application of manure to 27.75%.

Table 3. Effect of effective microorganisms in different fertilization on the total number of microorganisms in the rhizosphere of maize (10-6.g soil)

Hybrids	Mineral fertilization	Mineral fertilization +EM	Index Lavel	Manure	Manure+EN	Index Lavel
ZP 560	209,56	395,73	188,83	235,29	330,84	140,60
NS 4030	227,55	258,63	113,65	303,64	357,66	117,79
Average	218,55	327,18	149,70	269,46	344,25	127,75

In studies Cvijanović M. et al., (2014) in soybean production by using granulated poultry manure and mulitipnim inoculum with effective microorganisms in the rhizosphere soybeans increased the total number of microorganisms to 31.93% as well as a number of individual systematic groups ammonifiers 40.85%.

Table 4. Dynamics of the number of microorganisms in rhizosphere soybean by using multiple inoculum with effective microorganisms and organic fertilize

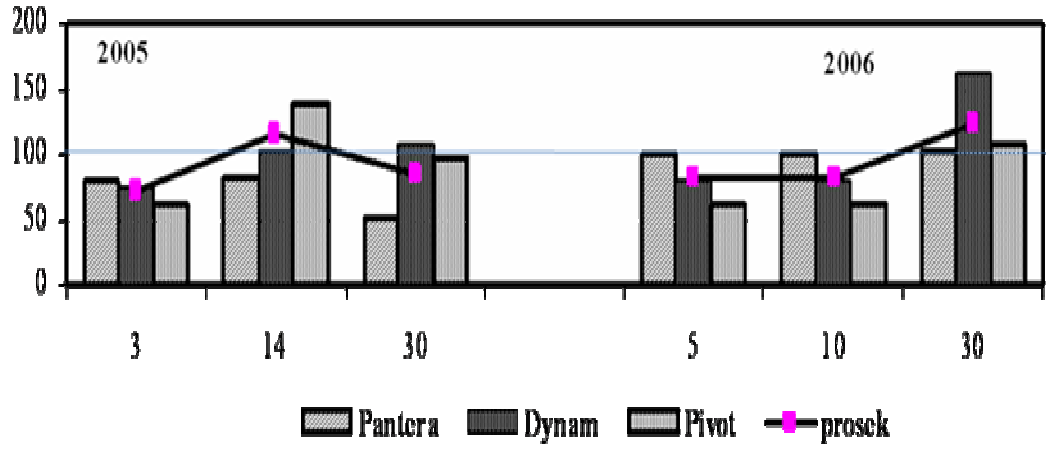
Fertilization	*Azotobacter*		Total number of microorganisms		Ammonifiers	
	10^2	Idex Lavel	10^7	Idex Lavel	10^4	Idex Lavel
Control	89,17	100	143,07	100	55,73	100
750 kg.ha^{-1}	31,50	35,33	246,33	172,17	72,10	129,37
150 kg.ha^{-1}	0,00	0,00	176,87	123,64	107,67	149,33
Average	40,22	45,11	188,76	131,93	78,50	140,85

The application of these inoculum eliminates the antagonism between microorganisms, the easier it ensures optimal environmental and nutritional conditions for the plant (Djukic et al., 2015).

2.2. Microorganisms as indicators of the presence of hazardous substances herbicide

In the increased yields, in addition to genetics, selection and mineral nutrition of cultivated plants, an important role was played by chemical agents (pesticides), which serves to protect plants. Given that today granted only on the Western European market, sale and use about 600 different pesticides, and that the number of pesticide manufacturers much greater, their use must be strictly controlled. Considering that certain areas are sprayed with pesticides several times, governments of some countries have enacted measures to reduce pesticide use by 50%. On the global market consumption of pesticides is around 29 billion dollars, of which 48% herbicide (Marrschall et al., 2003). It is believed that worldwide there are about 8,000 species of weed plants that are endangering cultivated plants, and the use of herbicides, protection against weeds, indispensable measures (Janjic et al. 2006). Their use per unit of area in Serbia is around 3 lit.ha-1. A larger number of scientists believe that herbicides negatively affect the whole agroecosystem and change it, because quantities into the soil beyond its ability to autopurification. Entering the herbicide into the soil, leading to direct contact with microorganisms. Ecotoxicity effects pollutants enhances the mutual interaction when found in soil and can cause genetic changes orgnizama in the soil. According to the structure of the herbicides can be carboxylic acids and their derivatives, phenoxy-carboxylic acid, urea derivatives, etc. whose semi time decomposition can take from 9 to 116 years, and would land where there is no microorganisms the application of herbicides caused far-reaching ecological consequences.

Microorganisms belonging to the most important role in the biological decomposition of pollutants. By constantly monitoring the microbiological activity can be determined by the operation of individual groups of pollutants. Low values of number of such as nitrogen fixing and enzyme oxidation-reduction process indicate a reduction of soil fertility (Milosevic et al. 2010). Most of the microorganisms in the soil has the ability to break down herbicides commonly using them as a source of carbon and nitrogen (Cook and Hutter 1981). Many years of research (Milosevic et al., 2006) show that some systematic and physiological groups (actinomycetes, Azotobacter) and enzymatic activity of a reliable indicator of the impact of herbicides on biological value. According to research Cvijanović et al., (2006) herbicides applied to soybean crops have significantly affected the percentage reduction in the number of azotobacters (graph. 1).On the decomposition of herbicides, in addition to types of microorganisms work and many biotic factors.



Graf. 1. Influence of herbicides in crop of soybean on dynamics number of azotobacters

Uncontrolled and inappropriate use of herbicides could adversely affect the agroecosystem, which still pulls and many other consequences. Disruption of ecological balance in agroecosystem occurs when it establish inhibition of microbial activity in the soil after 60 days from the application of herbicides.

3. CONCLUSION

Microorganisms are sensitive bioindicators ecotoxicity and give an informative assessment of the health of the land. Application of different groups of microorganisms can successfully be applied in crop production the most important crops of wheat, corn and soybeans.

Bacterization seeds before sowing symbiotic nitrogen-fixing in the production of soybeans and associative nitrogen fixers in the production of corn and wheat can significantly increase the total number of indigenous microbial population in the soil.

In the production of corn and wheat in this way can be replaced from 40-60 kg.ha-1 of mineral fertilizers, while soybean production mineral nutrition may be omitted altogether.

On basis of research related to the use of multiple inoculum with effective microorganisms can be concluded that a significant impact on increasing the total number of microorganisms at legume and non legume plant species, increasing the biological value of the land and prevent its degradation.

By maintaining the total number of microorganisms and increasing the abundance of some systematic and physiological groups can influence the rapid decomposition of the herbicide.

In the end we can say that the future of the application of these inoculum because there are economic and environmental benefit of their application, especially in sustainable food production.

Microorganisms are a constitutive element of agroecosystems.

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REFERENCES

Aghu S.K.,Oad F.C., Buriro U.A. 2004. Sield and sield components of inoculated un –inoculated sosbean under vasing nitrogen levels *Journal Plant Sci.* No 3 pp 370-371

Bacilio-Jimenez M, Agilar-Flores S, del Valle MV, Perez A, Zepeda A. 2001. Endophytic bacteria in rice seeds inhabit early colonization of roots by *Azosirillum brasilense*. *Soil Biol. Biochem.* No 33. pp 167-172

Cook A.M., Hutter R. 1981. S-Triazines as nitrogen sources for bacteria. *Journal of Agrical and Food Chemis* 29 pp 1135-1143

Cvijanović G. 2002. Effects of Diazotroph Bacteria om Yield and Microbiological activity in the soil under Maize, Wheat and Soyabean crops *Ph.D. Thesis* Faculty of Agriculture University of Novi Sad

Cvijanović G., Dozet G., Đukić V., Đorđević, Puzić S. G. 2012. Microbial activity of soil during the inoculation of soyabean with symbiotic and free-living nitrogen-fixing bacteria. *African Journal of Biotechnology*. IP 0.565 DOI: 10.5897/AJB11.744. Vol. 11(3), pp. 590-597.

Cvijanović G., Milošević N., Đalović I., Lalević B. 2006. The Dynamics of Soil Microorganisms Related to the Applied Herbicides. *Herbologia* ISSN 1840-0809 Vol 7, No2, pp 49-56.

Cvijanović M., Đukić V., Marinković J., Cvijanović G., Dozet G., Dragičević V. 2014. The importance of using organic inputs and electromagnetic waves in soybean production. *Proceedings of 7th International scientific/profesional conference: Agricultural in nature and environment protection*, ISSN 1848-545628th-30th May, Vukovar, Croatia, pp 241-246.

Djukic V., Cvijanovic M., Marinkovic J., Cvijanovic G., Dozet G., Miladinov Z. 2015. Application of low frequency electromagnetic waves (LFEV) AND Biological inputs in the Production of Soybean ISSN 0554-5579 (Printed) ISSN 1800-9492 (Online) *Journal Agriculture and Forestry* UDC (UDK) 635.657:631.816.3 Vol. 61/Issue 1 pp 7-15

Hajnal T., Jarak M., Milošević N. 2006. Microbial fertilizers in maize production-correlation between grain yield and microbiological parameters *Biotehnology* 2006 pp 948-9580

Higa T. 1991. Effective microorganisms:A biotehnology for mankid. *Proceeding of the First International Conference on Kyusei Nature farming* Research Center, Atami, Japan, pp 1-20

Janjić V., Drago Milošević, I. Đalović, Cvijanović G. 2006. Inportance and Role Adhibition Pesticides in aim of Developing Agricultural Production, UDC: 632.95:631.152, *Proceedings Multifuctional Agricultural and Rural Development (I) Economics Agriculture*, Special edition, Mali Zvornik, 7-8. decembar 2006. pp 367-38

Marinković J., Mrkovački N., Aćimović R., Đorđević V. 2010. Effect of NS Nitragin Application on Soybean Yield and Yield Components *Scientific Rescearch* on *Institute of Field and Vegetable Crops*, Novi Sad 2010 No47 (2) pp 545-548

Marshall J.P.E., Brown K.W., Boatman D.N., Lutman I.W.P., Squire R.G., Ward K.L. 2003. The role of weeds in supporting biological diversity within crop fields *Weed Research* Vol. 43, No. 2. pp 196-204

Milošević N., Cvijanović G. and Tintor B. 2006. Herbicides Effects on Microbial activity in Agricultural Soil. *Herbologia* ISSN 1840-0809. Academy of Sciences and Arts of Bosnia and Herzegovina. Vol 7, No2, pp 57-70.

Milošević N., Sekulić P., Tintar B., Cvijanović G. 2008. Monitoring healt/Quality of Soils near industrial zone in the Vojvodina Provincie, *Proceedings, Ecological Truth*, 01-04.06.2008. Sokobanja, pp 276-280

Milošević N., Sekulić P., Cvijanović G. 2010. Microorganisms as bioindicators of pollutans in soil. *Scientific Rescearch* on *Institute of Field and Vegetable Crops* Novi Sad. 2010:47 (1) CIP 631/635 (051) ISSN:0354-7698; ISSN 1821-3944 UDK: 631/635(051). str. 49-55.

Schwieger F, Tebbe C.C. 2000. Effect of field inoculation with *Sinorhizobium melilo*ti L33 on the composition of bacterial communities in rhizosphere of a target plant (*Medicago sativa*) and a non-target plant (*Chenopodium album*)-Linking of 16 rRNA gene-besed single-strand conformation polymorphism community profiles to the diversity of cultivated bacteria. *Appl. Environ. Microbiol*. No 66: pp 3556-3565.