STUDY OF THE MIBROBIOLOGICAL ACTIVITY VARIATION IN THE HAPLIC LUVISOL FROM CRISURILOR PLAIN

Aurelia ONET[1], Cristian ONEŢ[2]

Abstract. *Dynamics of biological activity of soil and seasonal variation of soil microorganisms may be the results of the changes occurring in soil chemistry. The chemical properties of soil influence the numerical presence of microorganisms. This paper presents the dependence between numerical variations of microorganism populations and chemical properties of haplic luvisol. The research was done in 2010 and 2011 on three soil variant such as: agricultural haplic luvisol, apricot haplic luvisol and paddock haplic luvisol. Total number of soil microorganisms, Actinomycetes, yeast-mold, Azotobacter and nitrifying bacteria was determined using the dilution method.*

Key words: seasonal variations, soil microorganisms, chemical properties

1.Introduction

The soil represents a favourable habitat for microorganisms and is inhabited by a wide range of microorganisms, including bacteria, fungi, algae, viruses and protozoa. Microorganisms are found in large numbers in soil - usually between one and ten million microorganisms are present per gram of soil - with bacteria and fungi being the most prevalent. [6]

Soil microorganisms are very important as almost every chemical transformation taking place in soil involves active contributions from soil micro-organisms. In particular, they play an active role in soil fertility as a result of their involvement in the cycle of nutrients like carbon and nitrogen, which are required for plant growth. For example, soil microorganisms are responsible for the decomposition of the organic matter entering the soil and therefore in the recycling of nutrients in soil. [7]

Certain soil microorganisms such as mycorrhizal fungi can also increase the availability of mineral nutrients (phosphorus) to plants. Other soil microorganisms can increase the amount of nutrients present in the soil. For instance, nitrogen-fixing bacteria can transform nitrogen gas present in the soil atmosphere into soluble nitrogenous compounds that plant roots can utilise for growth. These microorganisms, which improve the fertility status of the soil and contribute to

[1] Lecturer, PhD, University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea; Romania, e-mail: aurelia_onet@yahoo.com
[2] Lecturer, PhD, University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea; Romania, e-mail: cristyonet@yahoo.com

plant growth, have been termed 'biofertilizers' and are receiving increased attention for use as microbial inoculants in agriculture. [1]

2. Materials and methods

The research was done in 2010 and 2011 on three soil variant such as: agricultural haplic luvisol, apricot haplic luvisol and paddock haplic luvisol. In agricultural and apricot haplic luvisol are always applied chemical fertilizers and treatment with pesticides but paddock haplic luvisol is untilled soil and has no history of pesticides and fertilizers application. [5]
The experimental plots field is localized at 10 kilometers from Oradea, at village Cauaceu. In two years of study were made 72 determinations for each biological and chemical indicator of haplic luvisol.
The soil was collected from 0-20 and 20-40 profile of the haplic luvisol, in spring and autumn of years 2010 and 2011. In the laboratory plant material and soil 2mm) and mixed. macro fauna were removed and the soil samples were sieved (
Some chemical properties of the soil samples were determined as follows, soil moisture using gravimetrically method by oven-drying fresh soil at 1050C, pH in 1:2:5 soil water suspension by pH-meter, organic material by using Walkley-Black method, nitrate (NO3-N) determination by colorimetric method and ammonium with Nessler reagent. [8]
Total number of microorganisms, Actinomycetes, yeast-mold, nitrogen fixing bacteria and nitrifying bacteria were determined using the dilution method. These soil samples (10g), were suspended in 90 ml distilled water. Dilutions (of 10-6) were prepared from the soil samples using distilled water and these were dispersed with a top drive macerator for 5 min. The soil samples taken from suitable dilution were planted in or on the solid or liquid feeding medium as required.
Plate-count agar was used to estimate the total number of microorganisms, the number of Actinomycetes was determined on Agar with glucose and asparagines. The number of yeast-mold was determined in Sabouraud Agar, the number of Azotobacter in Ashby's glucose agar and the number of nitrifying bacteria was determined in nourishing solution Ashby. The cells of microorganisms were counted with colony counter and with the counting chamber (nitrifying bacteria). The results were evaluated as the number of microorganisms in 1 g oven-dried soil.
For statistically interpretation of results was calculated multiple correlation coefficient and F values based on the global significance test F. Also, was calculated a determination coefficient showing the proportion in which numerical microorganisms variations depends by the changes of chemical soil indicators. [2,3,4]

3. Results and discussions

The results of this research are presented in tables and graphics.

Table 1. Correlation between the total number of microorganisms, pH and humus

Variable	Average	Standard deviation	Correlation coefficient	Multiple correlation coefficient	F value
1X2	6,5485	0,8520	0,282610	0,296402	3,32
2X3	2,4783	0,6630	0,032520		
Dependent variable 3 X1	7.0528	0.7442			

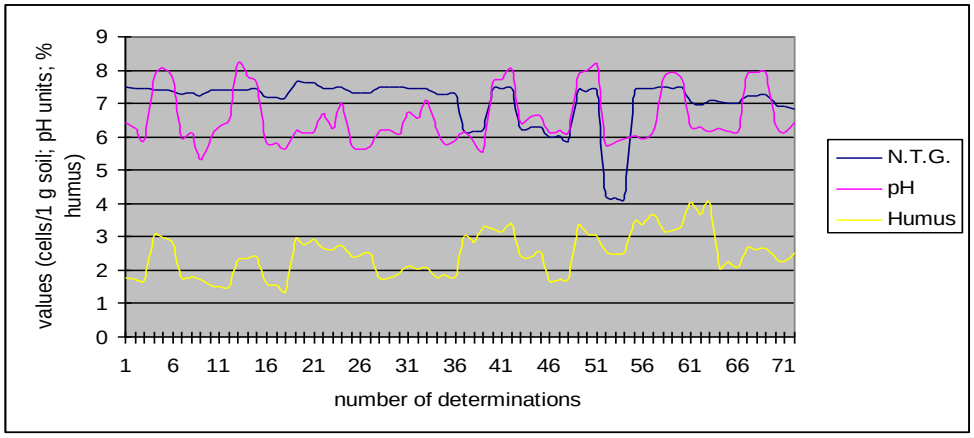

Fig. 1. Variation of the total number of bacteria depending on pH values and content in humus

The dependence between total number of microorganisms, pH values and humus content is statistically confirmed with a significantly distinct level (P=1%). Between total number of microorganisms and pH was established an acceptable correlation. As well, the number of microorganisms depends in a small measure by the humus content (the multiple correlation coefficient value indicated a low correlation). The determination coefficient value (d=8,41%) indicated that total number of microorganisms variation depends on the proportion of 8,41% by the pH and humus content variations.

Tabel 2. Correlation between the total number of *Actinomycetes*, moisture content and pH

Variable	Average	Standard deviation	Correlation coefficient	Multiple correlation coefficient	F value
1X2	12,2304	3,5765	0,061863	0,110805	0,42
2X3	6,5762	0,8144	0,098771		
Dependent variable 3 X1	5,6831	1,5884			

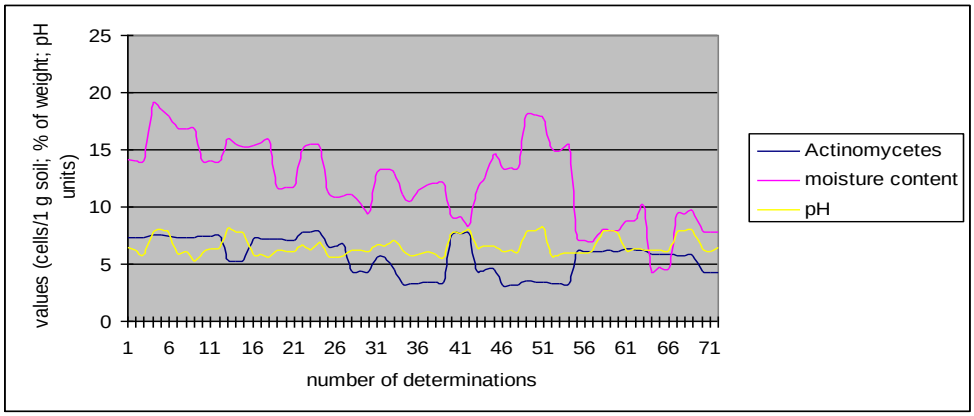

Fig. 2. Variation of the total number of *Actimomycetes* depending on moisture content and pH values

The correlation coefficient values indicated a low correlation between *Actynomicetes*, moisture content and pH values. This dependence is not statistically (insignificant level). The determination coefficient value was 1,2%.

Table 3. Correlation between the total number of yeast and mould, moisture content and pH

Variable	Average	Standard deviation	Correlation coefficient	Multiple correlation coefficient	F value
1X2	12,2304	3,5765	-0,128597	0,339602	4,49
2X3	6,5762	0,8144	-0,327623		
Dependent variable 3 X1	5,1297	0,09446			

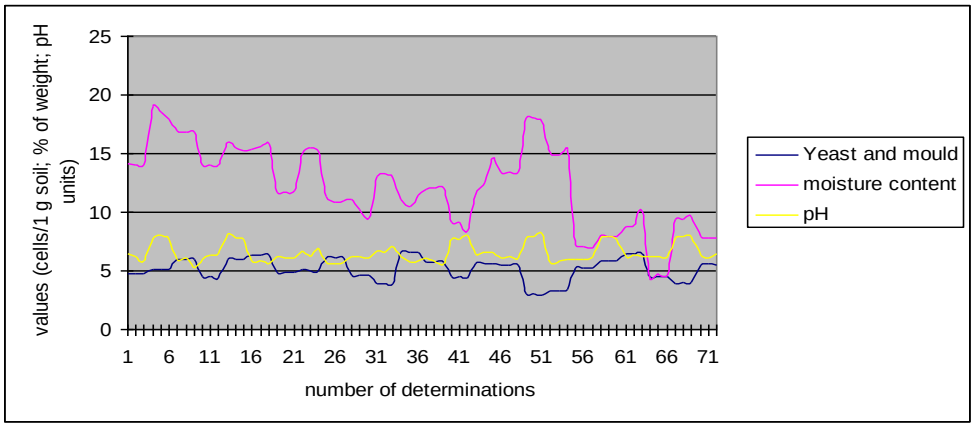

Fig. 3. Variation of the total number of yeast and mould depending on moisture content and pH

The correlation coefficient values indicate a low correlation (negative) between total number of yeast-mould and moisture content. An acceptable correlation was established between number of yeast and mould and pH values. Total number of yeast and mould depends by moisture content and pH and this dependence is very significant (p=0,1%). The determination coefficient was 10,89%.

Tabel 4. Correlation between the total number of nitrogen fixing bacteria, *Azotobacter*, ammonia nitrogen content and pH

Variable	Average	Standard deviation	Correlation coefficient	Multiple correlation coefficient	F value
1X2	2,6750	3,5024	0,184930	0,315372	3,81
2X3	6,5762	0,8144	0,282186		
Dependent variable 3 X1	1,8686	1,9387			

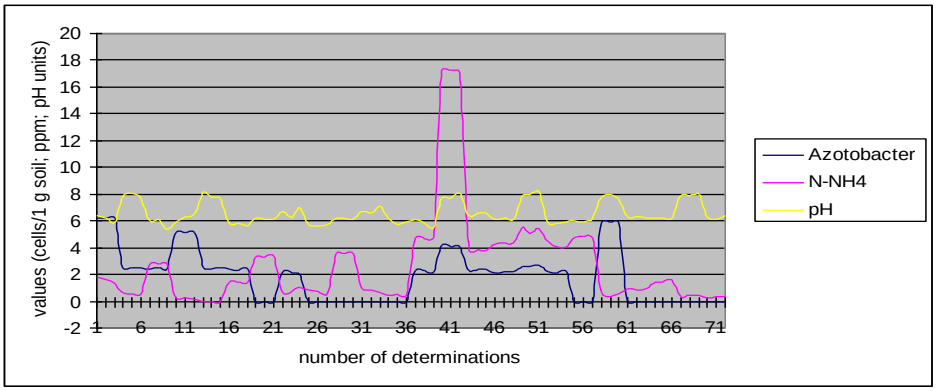

Fig. 4. Variation of the total number of nitrogen fixing bacteria depending on ammonia nitrogen content and pH values

An acceptable correlation was determined between *Azotobacter* and pH values and a low correlation between these and ammonia nitrogen content. This dependence is very significant (p=0,1%).
The numerical presence of *Azotobacter* depends in a proportion of 9,6% by the ammonia nitrogen content and pH variations.

Table 5. Correlation between the total number of nitrifying bacteria, nitric nitrogen and humus content

Variable	Average	Standard deviation	Correlation coefficient	Multiple correlation coefficient	F value
1X2	7,5750	6,4812	0,114944	0,137149	0,66
2X3	2,4783	0,6630	0,103570		
Dependent variable 3 X1	2,2852	2,0067			

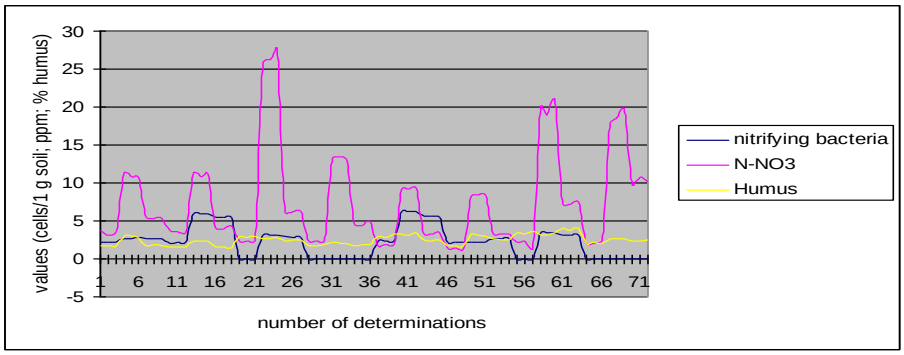

Fig. 5. Variation of the nitrifying bacteria depending on nitric nitrogen values and content in humus

A low correlation and insignificant dependence was determined between the number of nitrifying bacteria, nitric nitrogen and humus content. The determination coefficient value was 1,6%.

Table 6. Correlation between the total number of nitrifying bacteria, ammonia nitrogen content and pH

Variable	Average	Standard deviation	Correlation coefficient	Multiple correlation coefficient	F value
1X2	2,6750	3,5024	0,325443	0,388091	6,11
2X3	6,5762	0,8144	0,261642		
Dependent variable 3 X1	2,2849	2,0051			

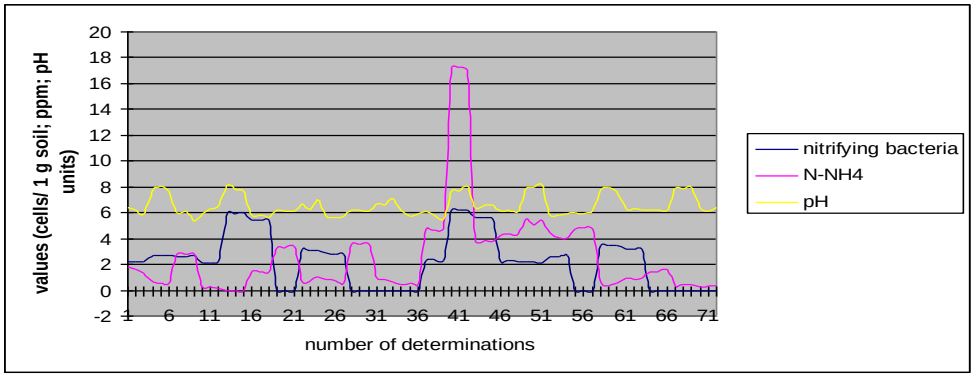

Fig. 6. Variation of the nitrifying bacteria depending on ammonia nitrogen content values and pH values

Between nitrifying bacteria number, ammonia nitrogen content and pH values was established an acceptable correlation and a significantly dependence (p=0,1%). The determination coefficient was 14,44%.

Conclusions

(1)The results presented in this research shows that seasonal variations of soil microorganisms depend by changes in the soil chemistry.
(2)A strong and significantly dependence was established between total number of microorganisms, pH and humus and between yeast and mould, pH and moisture content.
(3)Also, the numerical presence of nitrogen fixing bacteria depends by pH and ammonia nitrogen content and variations of nitrifying bacteria may be the results of ammonia nitrogen and pH variations.

References

[1] Collins, C.H., Lyne, P.M., Grange, J.M., Collins and LyneÕs., 1989, Microbiological Methods. Sixth Edition, London, Butterworths Co., Ltd., 410

[2]Digrak M., Kazanici F., 1999, Efects of some organohophorus insecticides on soil microorganism, Faculty of Arts-Science, Turkey.

[3]Drăgan-Bularda, M., Kiss. S., 1986, Soil Microbiology, Univ. Babeş-Bolyai, Cluj-Napoca.

[4]Dýûrak, M., Ozçelik, S., Effect of some pesticides on soil microorganisms, Bull. Environ. Contam. Toxicol., 60:916-922, 1998.

[5]Dýûrak, M., Ozçelik, S., Elik, S., 1995, Degradation of ethion and methidation by some microorganisms, 35 th IUPAC Congress, Istanbul. 14-19 August, p 84.

[6]Mulder, C., Joel E. Cohen, Heikki Seta, Jaap Bloemand Anton M. Breur1, 2005, Bacterial traits, organism mass, and numerical abundance in the detrital soil food web of Dutch agricultural grasslands, Ecology Letters.

[7]Oneţ Aurelia, 2010, Research on the influence of fertilizers and pesticides pollution on biological activity and other properties of soil in the plains crisuri, PhD Thesis.

[8]Yao H.Y., He Z.L., Wilson M.J., Campbell C.D., 2000, Microbial community structure in a sequence of soil with increasing fertility and ahanging and use, Microbial Ecology.