RESEARCH CONCERNING CHANGES OF THE MICROBIOLOGICAL CHARACTERISTICS AND BIOLOGICAL ACTIVITY OF PRELUVOSOIL UNDER DIFFERENT TREATMENTS WITH PESTICIDES AND CHEMICAL FERTILIZER MANAGEMENT

Aurelia Onet*

* University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea; Romania, e-mail: aurelia_onet@yahoo.com

Abstract

The productiveness of soil and his autopurification capacity are provided, in main, by the microbiological activity. The anthropics actions such as irrigation, fertilization, treatments with pesticides, and processing of soil, can affect the microbiota of soil (total viable bacteria, Actinomycetes, proteolytic bacteria, anaerobic bacteria, etc.) Also, the excessive use of chemical fertilizers and pesticides have often adversely affected the environment and created many problems (food safety, human and animal health problems). Investigation of the characteristics of preluvosoil microorganism ecosystem under different treatments with pesticides and chemical fertilizers showed that these treatments promoted specific microbial groups such as yeast-mold and nitrobacteria, while the Actinomycetes and the Azotobacter have registered a reduction. On the whole, in the treated preluvosoil, the total viable bacteria number was found to be lower than that of the control preluvosoil. In conclusion, the treatments were had small inhibitory effect on the development of the soil microorganisms groups.

Key words: soil, microorganism, fertilization, pesticides.

INTRODUCTION

Soil microorganisms are an important soil component because it plays a key role in soil nutrient cycling. Soil microbial biomass is considered to serve both as agent of biochemical changes in soil and as a repository of plant nutrients such as nitrogen (N) and phosphorus (P) in agricultural ecosystem (Jenkinson and Ladd, 1981). A few studies have revealed that microbial biomass is an important source of mineralizable soil organic N, and studies also have reported on the relationship between soil fertility and microbial biomass (Brookers , 1985).

This paper presents the results regarding the influence of different treatments with pesticides and chemical fertilizers on microbiological activity of agricultural preluvosoil.

MATERIAL AND METHODS

Experimental site

In this study will be investigate the response of microbial populations in preluvosoil after the application of several treatments with pesticides and chemical fertilizers. The soil samples were collected from experimental plots field at village Cauaceu, localized at 10 kilometers from Oradea, on March 15-19.2008. The soil was collected from upper 40 cm of the soil profile of a field treated with pesticides and chemical fertilizers (Table 1), and cultivated with grain and of a field that was untilled and which had no history of pesticides and fertilizers application.

Table 1

General layout utilization of chemical fertilizers and pesticides applies of agricultural preluvosoil

Vegetation season	CHEMICAL FERTILIZERS			PESTICIDES		
	Commercial name	Conc. Active substance %	Applied dose	Period of application	Commercial name	Applied dose
Spring	NH_4NO_3	33-34,5N	150 kg s.a./ha	**Before rising**	Profi	2 l/ha
Autumn	NPK	15 :15 :15	200 kg s.a./ha	**Vegetation period**	SDMA	1l/ha

In the laboratory plant material and soil macrofauna were removed and the soil samples were sieved (<2mm) and mixed. The number of total microorganisms, *Actinomycetes*, yeast-mold and nitrobacteria 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 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 Agar with glucose and the number of nitrobacteria in nourishing solution Ashby. The cells of microorganisms were counted with colony counter and with the counting chamber (nitrobacteria). The results were evaluated as the number of microorganisms in 1 g oven-dried soil.

RESULTS AND DISCUSSION

The microbial numbers determination (fig. 1) indicate that in the treated preluvosoil, comparative with control preluvosoil, the total viable bacteria number is more lower. In inferior profile of the control preluvosoil (20-40 cm) the microbiological activity is diminuaeted because this profile

is insufficiently aerated, the soil has an acid pH and the nourishing substances are reduces. Also, the presence of aluminums salts has inhibitory effects on the development of the soil microorganisms groups.

Table 2

Determination of principal's microbial groups' number presents in agricultural preluvosoil, comparative with control preluvosoil

Vegetation period	Microbiological indicator	Total microorganisms number (cells/1 g soil)			
		Control preluvosoil		Agricultural preluvosoil	
		0-20	20-40	0-20	20-40
Spring	Total microflora	$29,5x10^6$	$25,5x10^6$	$24,7x10^6$	$26,8x10^6$
	Actinomycetes	$22,4x10^6$	$28,5x10^6$	$33,9x10^6$	$229,2x10^3$
	Yeast-mold	$57x10^3$	$30x10^3$	$132x10^3$	$1,02x10^6$
	Azotobacter	$1,78x10^6$	$142x10^3$	323	285
	Nitrobacteria	158	134	537	$948x10^3$

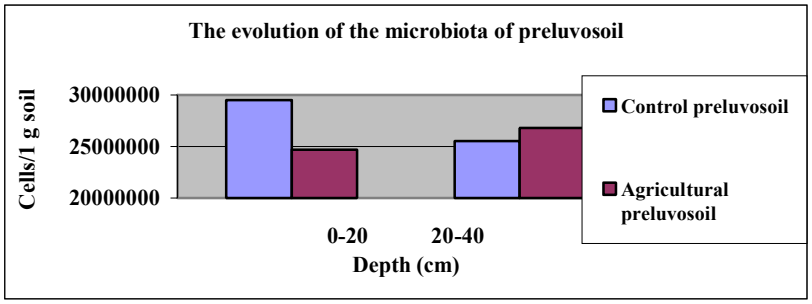

Fig. 1 The evolution of the microbiota of preluvosoil

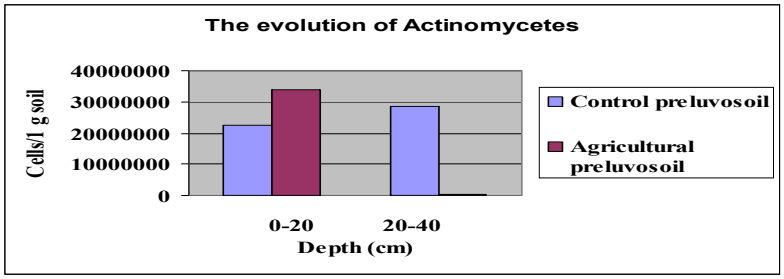

Fig. 2 The evolution of *Actynomycetes*

In the agricultural preluvosoil the number of *Actinomycetes* (fig. 2) is in decreasing comparative with the number of controle preluvosoil. The development of *Actinomycetes* depends by large conditions such as temperature and humidity. The *Actinomycetes* plays a key role in the process of hemicelluloses decomposition and this bacteria participate in the genesis of humus.

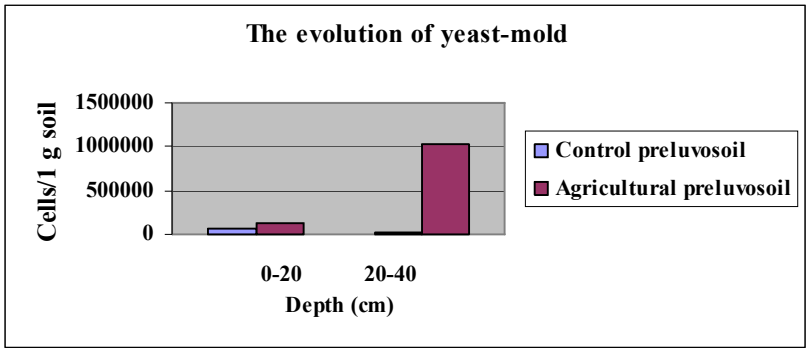

Fig. 3 The evolution of yeast-mold

Image no. 1 Colonies of yeast-mold

In the agricultural preluvosoil, in both profiles of the experimental field (0-20, 20-40 cm), the number of yeast-mold was found to be more higher than that of the control preluvosoil (fig.3). These microorganisms have an important role in affecting the persistence of pesticides, having the capacity for rapid elimination of highly persistent or toxic chemicals. Catabolism and detoxification metabolism occur when a soil microorganism uses the pesticide as a carbon and energy source.

The effects of pesticides and chemical fertilizers on the number of *Azotobacter* are presented in fig. 4.

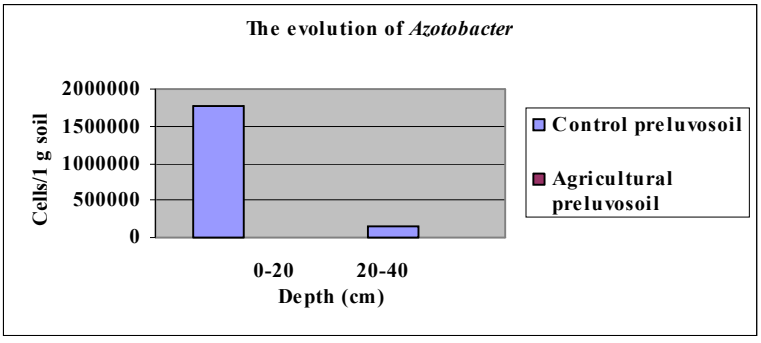

Fig. 4 The evolution of *Azotobacter*

As it can be seen, the treatments with pesticides and chemical fertilizers have inhibitory effect on the development of the *Azotobacter*. In the agricultural preluvosoil this bacteria are very undeveloped. The presence of aluminum salts has inhibitory effects on the development of this microbial group. *Azotobacter* is widely distributed in soils having a pH value of 6.0 or above. *Azotobacter* is able to utilize nitrates, ammonium salts, amino acids and peptones as a source of nitrogen, and will only assimilate atmospheric nitrogen when nitrogen in a combined form is absent from the substrate. The most recently studies have showed that the nitrobacteria are affected by the utilization of chemical fertilizers. As it can be seen in fig. 5, these microorganisms have been identified just in inferior profile (20-40 cm) of the experimental field of agricultural preluvosoil.

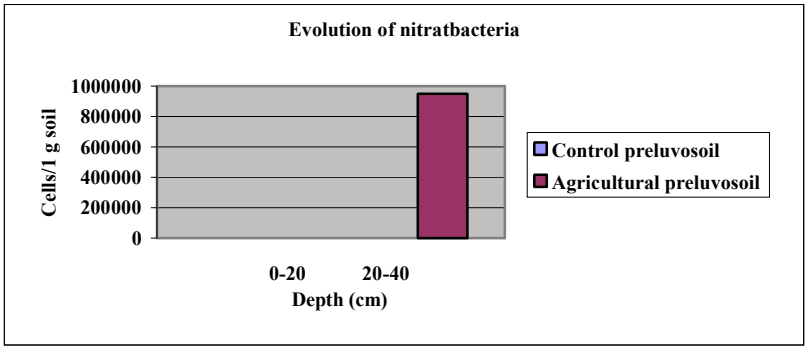

Fig. 5 Evolution of nitratbacteria

CONCLUSIONS

Microbial metabolism is an important process for degrading chemical substances in the soil environment. Biochemical research on pesticide metabolism over the last tree decades has attempted primarily to identify the microorganism's metabolites and enzymes associated, with a specific pesticide compound. In this study has been observed that pesticides and chemical fertilizers have significant effects on microbial activities and in generally, in long term, these treatments with pesticides and chemical fertilizers have inhibitory effects on certain groups of microorganisms.

REFERENCES

1. Athalye, M., J. Lacey, M. Goodfellow, 1981, Selective isolation and enumeration of actinomycetes using rifampicin. J.Appl. Bacteriol., 51, 289-297.
2. Bradshaw, J.L., Laboratory Microbiology.New York, 1992, Fourth.Saunders Colege Publishing,436.

3. Yentumi,D.S., D.B.Johnson,, 1986, Changes in soil microflora in response to repeated applications of some pesticides. Soil Biol.Biochem.18, 629-635.
4. Nemeth, T., 1996, Environment friendly fertilizer recommendation for sustainable agriculture. In: Environmental Pollution, Ed. B. Nath et All ECRP, Queen Mary and Westfield, college, London 99-105.
5. Samuel Alina Dora, 2003, Enzymological and microbiological evaluation of the effect of soil management practices on biology of soil, Publisher of University of Oradea, 6-8.