THE INFLUENCE OF SOIL MANAGEMENT PRACTICES ON MICROBIOLOGICAL PROPERTIES OF A CROPLAND AND ORCHARD FROM CRIŞURILOR PLAIN

Oneţ Aurelia*

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

Abstract

The researches were carried out in the spring of the year 2012 on the haplic luvisol cultivated in three variant: cropland (cultivared with wheat), orchards (apricot trees), and pasture. Soil samples were collected from plots of an experimental field localized at 10 kilometers from Oradea, at village Cauaceu, Bihor County. Total number of microorganisms and dehydrogenase activity were evaluated using the statistical method of signification (Student test). Total number of microorganisms from cropland was higher in comparison with the number of microorganisms counted in orchard. In the cropland cultivated with wheat was registered a dehydrogenase activity higher in comparison with the values determined in orchard. The results presented in this paper suggest that the changes in a soil's microbiological activity are caused by the long term use of pesticides and other agricultural chemicals.

Key words: cropland, orchard, microorganisms, dehydrogenase.

INTRODUCTION

Soil microorganisms can be used to assess soil quality or degradation. Microbiological properties can serve as soil quality indicators because after plants soil microbes are the second most important biological agent of the agricultural ecosystem. Enzyme activity is an important indicator of soil microbiological properties. Many discussions center on the effect of farming practices, such as chemicals and fertilizers on soil microorganisms and environmental quality.

Soil enzyme activities are influenced by management practices because they are also related to microbial biomass which is sensitive to different treatments. Each soil has a characteristic pattern of enzymes because all biochemical actions are dependent on or related to their presence.

In the literature there are many references about the relationship of enzyme activities and various soil properties. Soil enzymes are mainly of bacterial and fungal origin. Only a small fraction is derived from plants and/or animals. The enzyme most often found in soil are dehydrogenase, catalase etc.

MATERIAL AND METHODS

The soil samples were collected from an experimental plots field localized at village Cauaceu at 10 kilometers from Oradea, on March 2012. In the laboratory plant material and soil macrofauna were removed and the soil samples were sieved (<2mm) and mixed. The number of total bacteria was determined using the dilution method. These soil samples (10 g), were suspended in 90 ml distilled water. Dilutions (of 10^{-6}) were prepared from the soil samples using distilled water. 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 (Atlas, 2004). Incubation temperature was 28^{o}C. Time of cultivation was 3 days. The cells of microorganisms were counted with colony counter.

To 15g soil, were added 0,15g $CaCO_3$. The mixture was distributed in 2 test tubes. In first test tube 0,5 ml of a 3% solution of 2,3,5-triphenyl-tetrazolium chloride (TTC) and 1,5 ml distilled water were added. In the second test tube (control sample) were added only 2 ml distilled water. After incubation at 37^{0}C for 24h the formazan formed was extracted with 10 ml acetone and estimated spectrophotometrically at 485 nm. The concentration of formazan was calculated from a standard curve. Dehydrogenase activity is expressed as mg formazan formed/10 g soil·24h (Samuel et al, 2006).

RESULTS AND DISCUSSION

The results of the microbiological analysis of the haplic luvisol cultivated in three variants such as: cropland, orchard and pasture, suggest that between total number of microorganisms counted in pasture and that that of the cropland and orchard doesn't exist a significant difference ($p>0,10$). In cropland was found a number of aerobic mesophilic heterotrophs higher in comparison with the number counted in orchard (table 1). In orchard the number of aerobic mesophilic heterotrophs is reduced due to the use of pesticides.

Table 1

Determination of total number of microorganisms (cells/1 g soil)

Microbiological indicator	**Total number of microorganisms (cells/1 g soil)**					
	Pasture		**Cropland**		**Orchard**	
	0-20	**20-40**	**0-20**	**20-40**	**0-20**	**20-40**
Aerobic mesophilic heterotrophs	$29,5x10^6$	$25,5x10^6$	$24,7x10^6$	$26,8x10^6$	$19x10^6$	$15,1x10^6$

Dehydrogenase activity is a measure of the intensity of microbial metabolism in soil and thus of microbial activity in soil (Dragan-Bularda, 1986). Soil dehydrogenase activity is higher in the superficial profile of the soil (0-20) and lower in the inferior profile (20-40) (table 2). No significant difference was observed between dehydrogenase activity of pasture and that of the cropland and orchard ($p>0,05$) (table 2). Significant differences were registered between dehydrogenase activity of cropland and that of orchard ($p>0,01$). In cropland, dehydrogenase activity is higher in comparison with the activity registered in orchard (table 2).

Table 2

Soil dehydrogenase activity (mg formazan /10 g soil·24h)

Depth (cm)	Pasture	Cropland	Orchard
0-20	1,98	5,04	1,64
20-40	1,7	4,13	1,02

CONCLUSIONS

The effect of cultivation induced significant changes in the quality, chemical composition and molecular size of organic matter which in turn influenced the activities of enzymes involved in the C, N and P cycles.

Enzyme activity is also influenced by plants because was found higher in planted than in unplanted soils.

The results presented in this paper shows that soil enzyme activity and abundance of the microorganisms are influenced in main by different cropping systems, soil management and inputs of fertilizers and pesticides.

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