THE RELATIONSHIPS BETWEEN ENZYME ACTIVITIES AND MICROBIAL GROWTH IN THE HAPLIC LUVISOL FROM CRIŞURILOR PLAIN

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Abstract

In the literature there are many references about the relationship of enzyme activities and various soil properties. Even more research exists on how the physicochemical properties of soil can influence the activity of soil enzymes. The research was done in the year 2012 on the haplic luvisol from Crisurilor plain cultivated in three variant such as: cropland, orchard and pasture. To established the relationship between dehydrogenase activity and count of aerobic mesophilic heterotrophs soil samples were collected from an experimental plots field localized at village Cauaceu, Bihor County. The results show the strong positive correlation between enzymatic activities of haplic luvisol and total number of microorganisms determined in the haplic luvisol cultivated in different cropping systems.

Key words: soil, microorganisms, dehydrogenase.

INTRODUCTION

Soil enzyme activities are often used as indices of microbial growth and activity in soils (Frankenberger, Dick, 1983).

The activity of any particular enzyme in soil is a composite of activities associated with various biotic and abiotic components, e.g. proliferating cells, latent cells, cell debris, clay minerals, humic colloids and the soil aqueous phase.

The location of the enzyme is at least partially determined by such factors as the size and solubility of its substrate, the species of microorganism, and the physical and chemical nature of the soil colloids (Burns, 1982).

Also, enzyme activities can be an integrative soil biological index of past soil management, and involve procedures that are relatively simple compared to other important soil quality properties.

MATERIAL AND METHODS

The researches were carried out in the year 2012 on the haplic luvisol. The soil samples were collected from an experimental plots field localized at village Cauaceu from Oradea, Bihor County.

The haplic luvisol is cultivated in three variant such as: cropland (wheat crop), orchard and pasture. The agricultural use of cultivated orchards are always applied chemical fertilizers and treatment with pesticides but the untilled soil from pasture has not got any history pesticides or fertilizers.

Total number of aerobic mesophilic heterotrophs was determined using the dilution method. The soil samples (10 g) 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 shaker for 5 min.

Plate count method was used to estimate total number of microorganisms on a solid nutrient medium containing meat extract (Atlas, 2004).

Dehydrogenase activity was estimated spectrophotometrically and expressed as mg formazan formed/10 g soil·24h.

The relationship between enzyme activity and microbial growth in haplic luvisol was represented by correlations between dehydrogenase activity and total number of microorganisms.

RESULTS AND DISCUSSION

The evolution of soil microbiota indicate that the cropland and orchards presented a number of total microorganisms lower in comparison with the number of microorganisms counted in pasture (table 1).

Soil dehydrogenase can be taken as a representative enzyme in soil fertility studies because it is closely associated with soil microbial activity (Garcia, Hernandez, 1997; Quilchano, Maranon, 2002). Dehydrogenase is responsive to soil environment (Caldwell, 2005). Hence, any fluctuation in the soil properties like aeration (Brzezinska et al, 2001), organic content (Gajananda, 2007), presence of xenobiotics (Gao et al, 2010), agricultural practices like use of pesticides and herbicides (Stepniewska et al, 2007) will influence the enzyme. It can also indicate the type and significance of pollution in soils (McCarthy et al, 1994; Pitchel, Hayes, 1990).

Dehydrogenase activity presented high values in cropland in comparison with the values registered in pasture and orchards (table 2).

The results show the strong positive correlation (r=1) between enzymatic activities of haplic luvisol and total number of microorganisms determined in all the three variant of the haplic luvisol (fig. 1, 2, 3).

Table 1

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

Total number of aerobic mesophilic heterotrophs (cells/1 g soil)					
Pasture		**Cropland (wheat crop)**		**Orchard**	
0-20	20-40	0-20	20-40	0-20	20-40
$29{,}5x10^6$	$25{,}5x10^6$	$24{,}7x10^6$	$26{,}8x10^6$	$19x10^6$	$15{,}1x10^6$

Table 2

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

Pasture	Cropland	Orchard
1,98	5,04	1,64
1,7	4,13	1,02

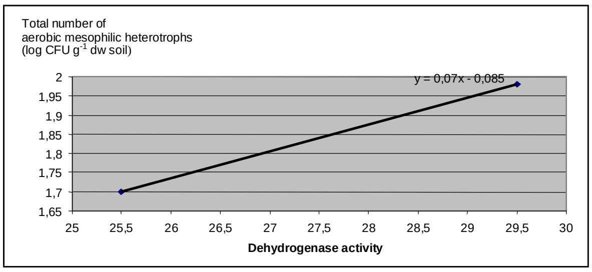

Fig. 1. Correlation between dehydrogenase activity and total number of microorganisms counted in pasture

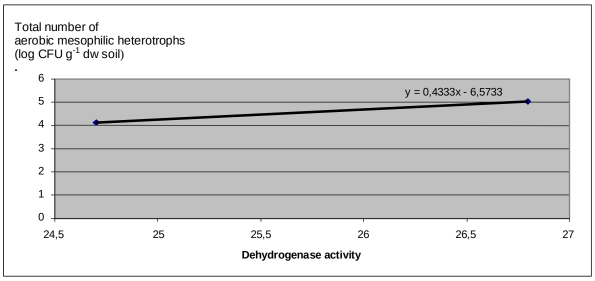

Fig. 2. Correlation betwen dehydrogenase activity and total number of microorganisms from cropland

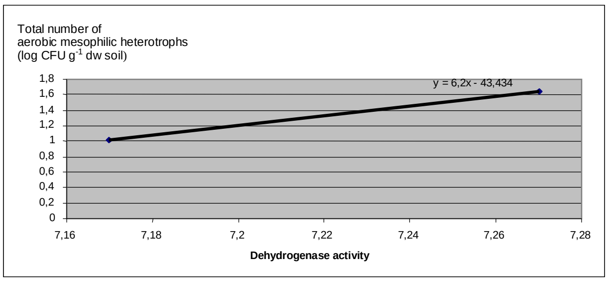

Fig. 3. Correlation between dehydrogenase activity and total number of microorganisms counted in orchard

CONCLUSIONS

Dehydrogenases reflect physiologically active microorganisms and thus provide correlative information on biological activities and microbial populations in soils.

Enzymatic activity is an important indicator of soil microbiological properties. Dehydrogenises are enzymes produced by various microorganisms and act intra- cellular. Dehydrogenase activity presented high values in cropland in comparison with the values registered in pasture and orchards. From research it is evident the strong positive correlation between enzymatic activities of haplic luvisol and total number of microorganisms determined in the haplic luvisol.

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