vol. XII, 2007

RELATIONSHIP BETWEEN SOIL ENZYMES AND PHYSICOCHEMICAL PROPERTIES OF PRELUVOSOIL

Aurelia Onet *, C. Onet*, V. Laslo*

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

Abstract

Soil is a heterogeneous medium of solid, liquid, and gaseous phases varying in its properties both across the landscape and in depth (Lou and Zhou, 2006). 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. The role of soil enzymes, in terms of the ecosystem, is increasingly important and is defined by the relationships between soil enzymes and the environmental factors affecting their activities. Perhaps the most valuable single use of soil enzymes is to assess the effects of various inputs on the relative " health" of the soil. Numerous studies have been conducted to determine changes in a soil'enzyme activities caused by pesticides, fertilizers, and other agricultural chemicals.

Key words: soil, microorganism, enzymes, properties.

INTRODUCTION

In the literature there are many references about the relationship of enzyme activities and various soil properties. Soil enzyme activities are influenced by management practices because they are also related to microbial biomass which is sensitive to different treatments. (Samuel Alina Dora, 2006). Even more research exists on how the physicochemical properties of soil can influence the activity of soil enzymes.

MATERIAL AND METHODS

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 agricultural preluvosoil, fruit-growing preluvosoil and control preluvosoil. In the laboratory plant material and soil macrofauna were removed and the soil samples were sieved (<2mm) and mixed. Some physical and chemical properties of the soil samples were determined as follows, soil moisture using gravimetrically method by oven-drying fresh soil at 105^oC, 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, ammonium with Nessler reagent, P mobile and K mobile by using

extraction with Egner–Riehn–Domingo. In our investigation we have analyzed, also, the activity of dehydrogenises. To 15g soil, were added 0,15g CaCO₃ 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° 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 TPF/10 g soil \cdot 24 h.

RESULTS AND DISCUSSION

The fluctuation of the biological activity of soils depends on the pH, humus N, P, K content and in connection with the season, the moisture content.

Table 1

| Year | Vegetation period | Depth (cm) | Control preluvosoil | Agricultural preluvosoil | Fruit- growing preluvosoil |
|------|-------------------|---------------|------------------------|-----------------------------|----------------------------------|
| 2008 | Spring | 0-20 | 1,98 | 5,04 | 1,64 |
| | | 20-40 | 1,7 | 4,13 | 1,02 |

Soil dehydrogenises activity (mg TPF /10 g soil·24h)



Fig.1 Soil dehydrogenase activity (mg TPF formed/10 g soil·24h)



Fig. 2 Correlation between dehydrogenase activity and pH

As it can be seen, in fig. 2 between dehydrogenase activity and pH is a strong correlation (r=0,97). These enzymes are produced by various organisms and act intra- or extra- cellular.

Soil enzymes are mainly of bacterial and fungal origin, and in conclusion, increasing of the pH values is strong correlated with increasing of enzymes activity.



Fig. 3 Correlation between dehydrogenase activity and content in N-NO₃ of preluvosoil

To observe the biological activity of preluvosoil depending of the content in N-NO₃ dehydrogenase activity was correlated with N-NO₃. Dehydrogenase activity showed a strong positive correlation to soil content in N-NO₃ (r=0.93).



Fig.4 Correlation between dehydrogenase activity and content in N-NH₄





Fig. 5 Correlation between dehydrogenase activity and P mobile

As it can be seen, dehydrogenase activity depends by the content in P of preluvosoil. (r=0.97)



Fig. 6 Correlation between dehydrogenase activity and content in K

Fig.6 shows the strong correlation between dehydrogenase activity and content in K mobile of preluvosoil. (r=0.92)



Fig. 7 Correlation between dehydrogenase activity and humus

Several enzymes are known to be present in the soil which catalyze organic matter turnover. In this way, between the content in humus and dehydrogenase activity exist a strong positive correlation (r=0.97).



Fig. 8 Correlation between dehydrogenase activity and soil moisture

Correlation coefficient (r=0,59) show that dehydrogenase activity depends in a small measure by the moisture content of preluvosoil.

CONCLUSIONS

From research it is evident that physicochemical properties of soil can influence the activity of soil enzymes.

The results presented in this study showed the strong correlation (r=1) between enzymatic activities of preluvosoil under different management practices and cultivation condition (uncultivated preluvosoil, agricultural and fruit-growing preluvosoil) and the pH, content in humus, N-NO₃, N-NH₄, mobile phosphorus, mobile potassium.

Also, enzymatic activity depends in a small measure by the moisture content of preluvosoil.

REFERENCES

- 1. Burns, R.G., 1982, Enzyme activity in soil: Location and a possible role in microbial ecology, Soil Biol. Biochem.14:423-427
- 2. Casida, L.E.JR, 1964, Soil dehydrogenase activity, Soil Sci. 98, 371-376.
- 3. Lou Y., X. Zhou, 2006, Soil Respiration and the Environment. Academic Press and Elsevier Inc., Burlington.
- Paul E.A., 2007, Perspective in soil microbiology, ecology and biochemistry. In: Paul E.A. (ed.): Soil Microbiology, Ecology and Biochemistry, Vol.3. Academic Press and Elsevier Inc., Burlington:3-24.
- Samuel A.D., M. Dragan-Bularda, C. Domuta, 2006, The effect of green manure on enzymatic activities in a brown luvic soil. Studia Universitatis Babes-Bolyai, Biologia, LI,1, 83-93.
- Samuel A.D., M. Dragan-Bularda, C. Domuta, 2006, The effect of irrigation on the enzymatic activities in a brown luvic soil. Studia Universitatis Babes-Bolyai, Biologia, LI,1, 93-103.
- 7. Soil Survey Staff, 1993, Soil Survey Manual. USDA Handbook No.18, Washington, D.C.