



## RESEARCH REGARDING THE TILLAGE IMPACT ON SOIL ACID AND ALKALINE PHOSPHATASE ACTIVITY

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acide phosphatase

### SYNOPSIS

The aim of the study was to assess the activity of phosphatases in agricultural soils (fertilized and unfertilized) from Romania, harvesting at two depths (7-10 cm and 15-25 cm) as well as the effects of the tillage on soil enzyme activity. The results show that both acid and alkaline phosphatases, detected in the soil from mai 2008, presents a higher activities in the soil harvested from surface (7-10 cm). The tendece of the phosphatase activity is increase in the fertilized soil than unfertilized soil at the two depths.

### INTRODUCTION

Soil microorganisms can be sensitive biological markers and can be used to assess soil quality or degradation. Thus, microbiological properties can serve as soil quality indicators because after plants, soil microorganisms are the second most important biological agent of the agricultural ecosystem (Dick, R.P., 1994). There are many indicators of soil microbiological properties including microbial biomass content, microbial diversity and activity, and enzyme activity. Soils enzymes originate from different sources (animal, plant and microorganisms) and the resulting soil biological activity includes the metabolic processes of all these organisms (Sikora L. J. et al. 1995).

Soil enzymes are important for catalyzing in numerable reactions necessary for life processes of microorganisms in soils, decomposition of organic residues, cycling of nutrients, and formation of organic matter and soil structure (Elcio Liborio Balota et al. 2004).

The main enzymes involves in the mineralization of soil organic phosphorus are phosphatase intracellular (alkaline) and extracellular (acide). The activities of both acid (E.C. 3.1.3.2.) and alkaline (E.C. 3.1.3.1.) phosphatases are influenced by various soil properties, soil organism interactions, vegetation cover and the presence of inhibitors or activators.

The aim of the study is to assess the activity of soil phosphatases in Romania region agricultural maize cultivated soils (fertilized and unfertilized) from Romania, collected from two depths (7-10 cm and 15-25 cm) as well as the effects of tillage on soil biological properties.

## MATERIAL AND METHODS

The experiment site is located at Iezăreni, near Iași and the soil samples – fertilized (F) and unfertilized (N) were taken in the maize plots in may 2008, from different depths (7-15 cm and 15-25 cm) to characterize the phosphatases (acid and alkaline) soil activity. Soybean was the precursory crop. The working systems utilized in a fertilized soil and the notation of this were: plough at 20 cm depth (AF-20), plough at 30 cm depth (AF-30), disc (DF), paraplow (PPF) and chisel (CF). In unfertilized soil were utilized the same working systems: plough at 20 cm depth (AN-20), plough at 30 cm depth (AN-30), disc (DN), paraplow (PPN) and chisel (CN).

Acid and alkaline phosphatase (EC 3.1.3) activity was determined by method using a modified buffer with pH 6.2 for acid phosphatase and pH 8,6 for the alkaline phosphatase (Artenie V. et al., 2008).

## RESULTS AND DISCUSSIONS

Many reactions involving soil organic matter transformations may be catalyzed by enzymes existing outside the microorganisms and plant root system.

Each soil may have a characteristic pattern of specific enzymes. The differences in the level of enzymatic activity depending on the origin and developmental conditions of every soil type, the content of organic matter and the activity of living organisms. An important technological feature to adopt a soil tillage system is the weeding state and the texture of the soil.

Soil tillage systems practiced in Romania are various and comprise a large range of variants, from conventional to unconventional ones. Thus, for the maize crop, the unconventional systems which include the tillage of the soil with chisel and paraplow are being preferred (Guş P et al., 2002).

The texture and soil structure, namely the granulometric composition are linked to its physical, chemical and biological. In both fertilized soil profiles analyzed (7-10 cm and 15-25cm), the alkaline phosphatase activity recorded, generally, higher or comparable values in the case of variants collected from 7 – 10 cm depth, compared with those harvested from 15 – 25 cm (Figure 1). This behaviour can be explained by that number of microorganisms in the soil surface is superior to that of depth. An exception is situation in which the soil is plough at depth of 30 cm when the investigated enzyme activity is higher than that recorded for 15 – 25 cm depth.

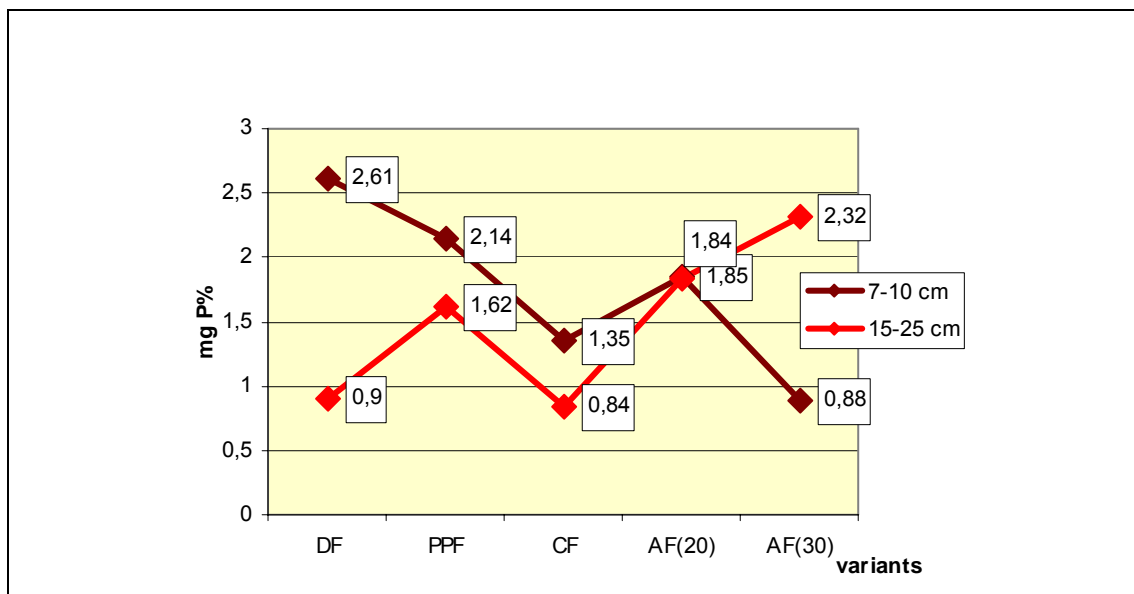


Figure 1. Variation of alkaline phosphatase at fertilized soil, harvested from different depths, subjected to different types of agrotechnical works

On the unfertilized soil the alkaline phosphatase activity profile of soil collected from 7-10 cm depth is greater in the case of agrotechnical works compared with the soil sample harvested from 15-25 cm, the similar manifestation with the fertilized soil (Figure 2). The amplitudes of the enzymatic activities values are different depends on the type of the work applied to soil. In the experimental variant noted conventional CN investigate enzyme activity is greater at the profile harvest from 15-25 cm depth.

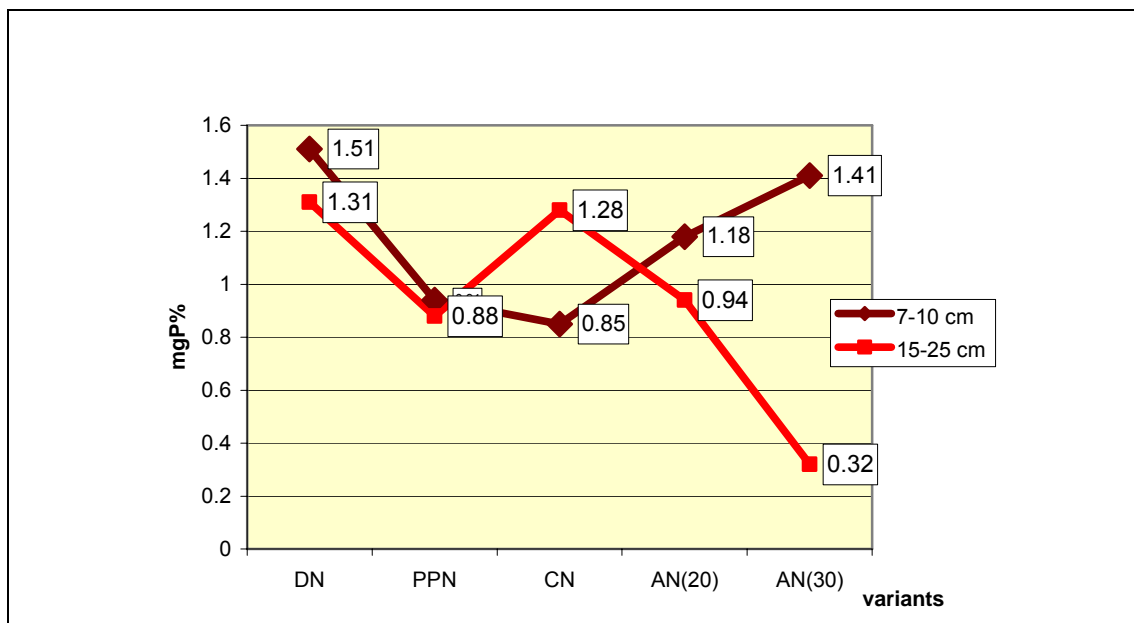


Figure 2. Variation of alkaline phosphatase at unfertilized soil, harvested from different depths, subjected to different types of agrotechnical works

The comparative study of the acid phosphatase activity in fertilized and unfertilized soils harvested from the depth of 7-10 cm, which were carried out various agricultural works, reveals that the alkaline phosphatase is generally higher in cases where the soil was been fertilized with organic substances (Figure 3). Introduced organic substances in the soil represent sources of energy used by microorganisms that is the reason for microbial biomass and activity of enzymes may increase after adding the energy source, consistent with the research aspect present in literature (Guan, 1989). Thus, the research showed that alkaline phosphatase and microbial biomass can significantly increase after the application of organic manure (organic fertilizer) while the acid phosphatase increase significantly in a soil with inorganic fertilizers; the reason is that the phosphorous from manure is relatively more mobile compared to that of inorganic fertilizers (Marinari S. et al. 2000, Kanchikerimath et Singh, 2001).

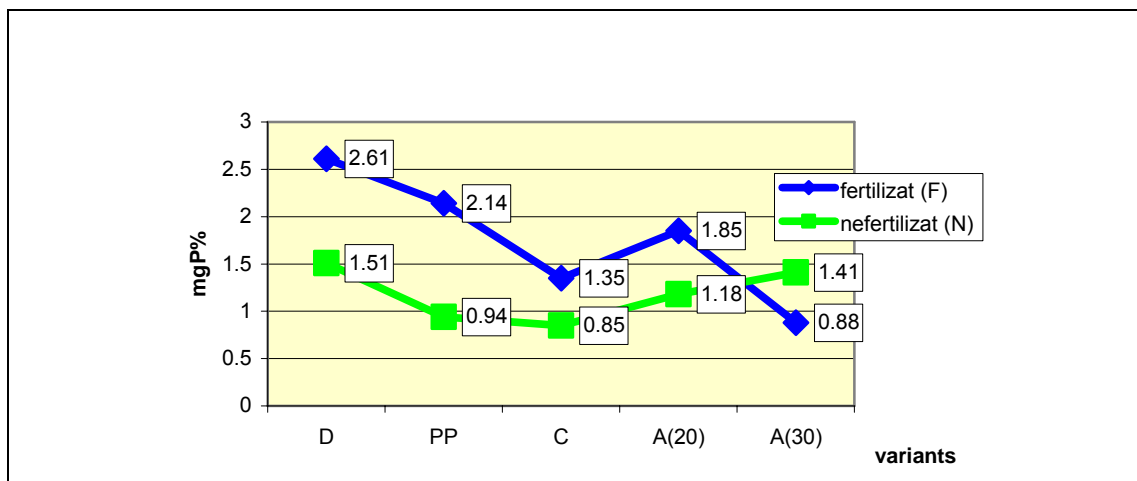


Figure 3. Variation of alkaline phosphatase at unfertilized soil, harvested from 10-15 cm depth, subjected to different types of agrotechnical works

Soil samples taken from 5-25 cm depth presents different alkaline phosphatase activity. Thus, the amplitudes of these depending on treatment and agricultural work carried out on the ground. The graphic representation of these values recorded a variety of these, presented like image in the mirror, when are taken into account the criteria mentioned above (Figure 4). A possible explanation for this behaviour consists in the fact the different working system influenced the soil enzymatic activities, because of different physical condition they cause.

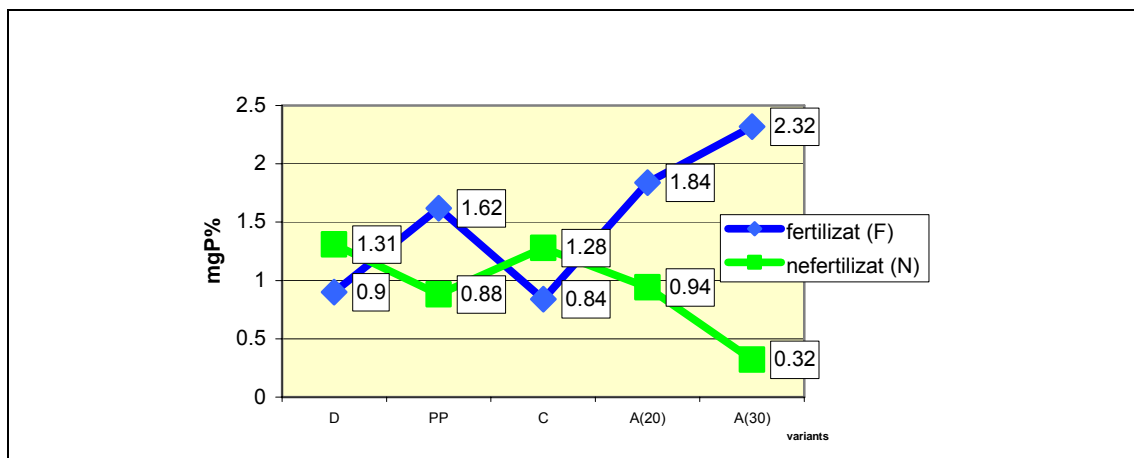


Figure 4. Variation of alkaline phosphatase at unfertilized soil, harvested from 15-25 cm depth, subjected to different types of agrotechnical works

The acid phosphatase activity from fertilized soil taken from different depths is fluctuant showing bigger or smaller amplitudes depending on different the type of agrotechnical works performed (Figure 5). Thus, while the depth of 7-10 cm soil enzymatic activity is increased, the depth of 15-25 cm is low and vice versa. This variation probably depending on the reaction of microbial populations in soil, as a consequence of carrying out agricultural work.

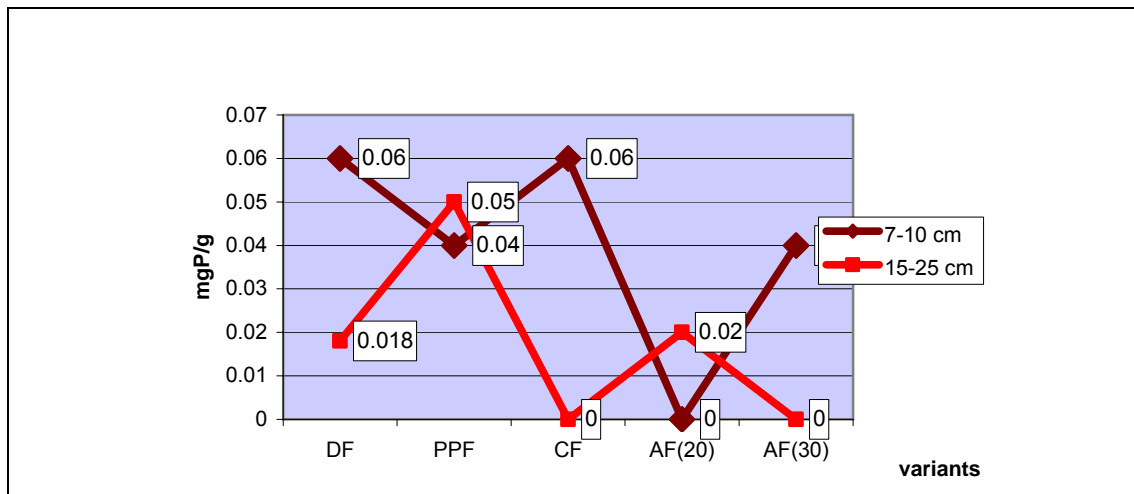


Figure 5. Variation of acid phosphatase at fertilized soil, harvested from different depths, subjected to different types of agrotechnical works

In the unfertilized soil, taken at both depths, the acid phosphatase is extremely low (Figure 6). The ploughing effected at 20 cm depth causes the intensify of the enzyme activity analysed, for both sampling soils The acid phosphatase has maximum value in the case of ploughing at 30 cm depth for both soil level studied. Acid phosphatase activity recorded the maximum value if the ploughing is effected

executed at 30 cm deep and the magnitude is comparable for both studied soil profiles.

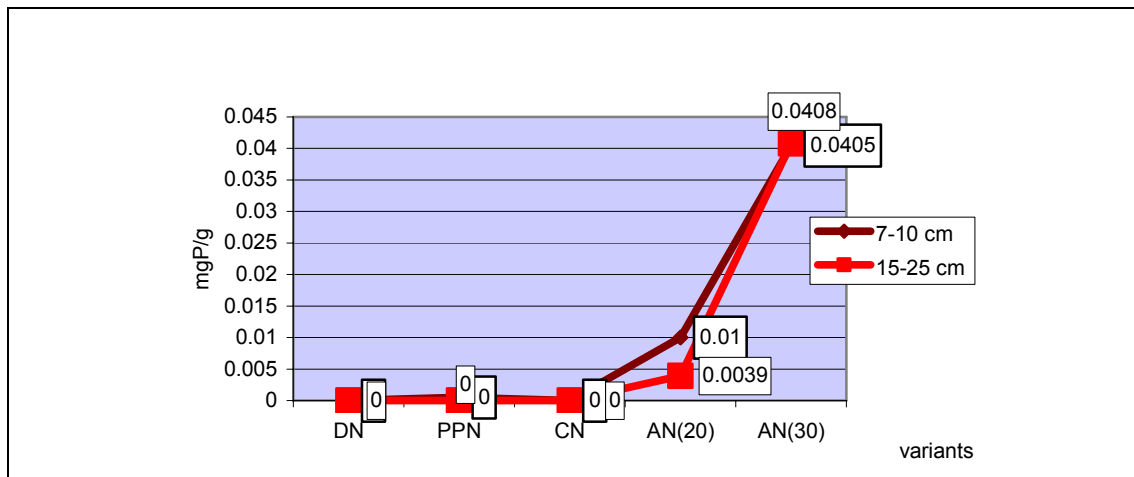


Figure 6. Variation of acid phosphatase at unfertilized soil, harvested from different depths, subjected to different types of agrotechnical works

The phosphatase activity in unfertilized soil is reduced compared with the enzyme activity in fertilized soil, taken from the same depth, due to the introduction of the phosphorus by fertilizers (Figure 7).

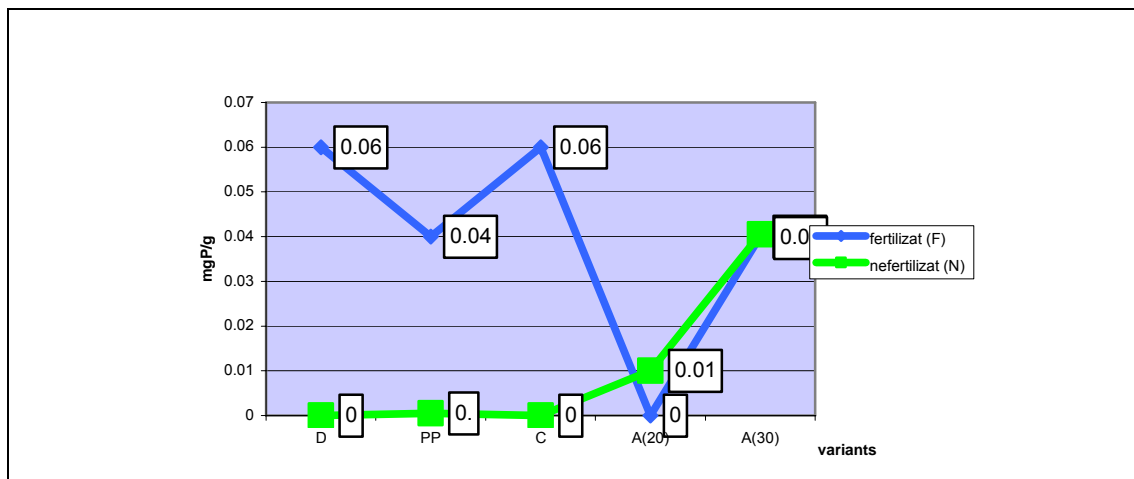


Figure 7. Variation of acid phosphatase at unfertilized soil, harvested from 7-10 cm depth, subjected to different types of agrotechnical works

In the unfertilized profile of soil harvested from 15-25 cm, the acid phosphatase activity show the same trend as in the case of the case of the soil profile harvested from 7-10 cm (Figure 8). Acid phosphatase activity in fertilized soil is different showing amplitudes depending on the type of agrotechnical works performed.

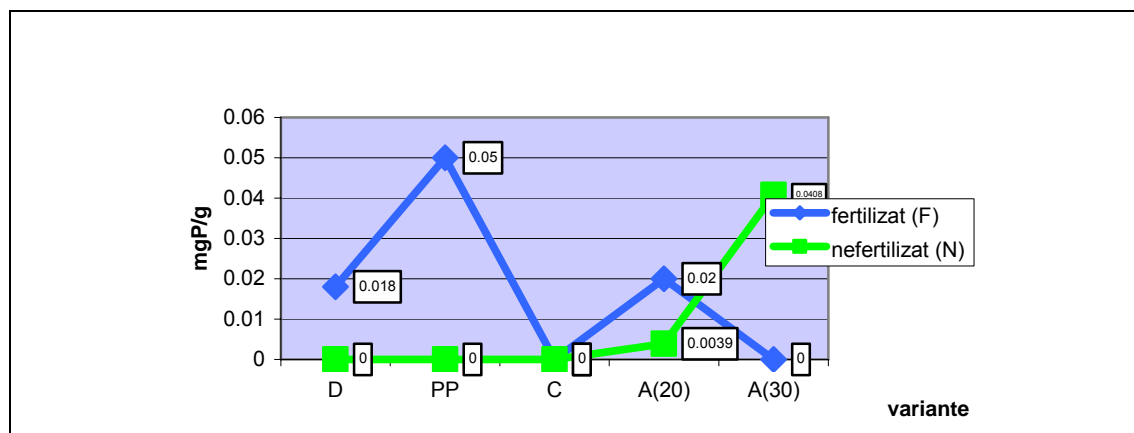


Figure 8. Variation of acid phosphatase at unfertilized soil, harvested from 15-25 cm depth, subjected to different types of agrotechnical works

## CONCLUSION

The results obtained indicate that the soil phosphatases activity (acid and alkaline) is greater in the fertilized soil comparatively with the unfertilized.

These amplitudes of the phosphatase activity are variable and depend on the type of the working system effected, the treatment effected but also the depth at which the sample were taken.

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