# Spatial variability phosphorus in different soil types

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Expert paper

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## Abstract

Information about spatial variation of phosphorus content in soils is requived for developing site-specific P fertilizer management practices and assessing environmental effects of P fertilization in the present work, top soil (o-20 cm) and 30-45 cm depth soil samples were taken and P content of 15 types of soil was determined using acetate-lactate extractable solution and Murphy – Riley measurement method.

The data suggest that differences in the soil physico-chemical properties significantly influence the content of available P at 30-45 cm depth.

**Key words:** acetate – lactate extractant; environmental effects; Murphy-Riley method; soil phosphorus

## Introduction

Different classes of acid soils in the North-Western Romania (molisols, clay luvisols, cambisols, hidromorphsoils and vertisols) present law productivity, inadequate soil management, the lack of maintenance fertilization or the irregular supply of nutrients are pointed as causes for decline yield.

The natural vegetation destined to pastures contents acidophyl species as Poa pratensis, Alopecurus pratensis, Agrostis tenuis, Festuca rubra, Deschampsia caespitosa or Trifolium repens, Trifolium pratense, Lotus corniculatus etc. Some soils are cultivated with wheat, corn, potatoes, barley, oat, lineu and hemp.

The reclamation of cultivated soils presumes a knouwledge on soil fertility fluctuations, the greatest interest refens to available P content, since is one of the mast limiting nutrients for plants. On the other hand a measure of soil P status in agricultural soils is generally required for assisting with prediction of potential P lass from agricultural catehment and assessing risk for water quality.

## Materials and methods

The study was conducted on fields with an average size of 1,0 ha from 8 villages situated in the North - Western Transilvania, Romania. Soils were wapped as typical clay-illuvial chernozom, typical cambic chernozem, albic luvisoil, clay-illuvial brauw soil, amphigleic, brauw eumezobazic, vertisol, gleic, psamosol, lacoviste cambica, solonetz, pseudogleic, alluvial and brawn luvic.

Detailed land use and agronomic management data are collected through Rumanian Statistic Annual (2004-2005). Each field was considered as a separate unit because is not mamaged in a coherent rotation. In the 5 years prior to sampling each field reoived 80 kg$P_2O_5$/ha as superphosphate.

In 2005, five representative points on each type of soil were selected for sampling. A total of 30 samples were separately bagged into 0-20 cm and 30-45 cm depth. All soil contained in the bags of 5 cares were ground and thoroughly mixed. 5 g of air dried, seived (2 mm) soil was shaked 30 minutes with 100 ml acetic acid – ammonium lactate solution (pH=3,75) (AL solution) and 5 ml filtrate was treated with $(NH_4)_2MoO_4$ 0,15%, 5 ml fresh prepared 1,5% ascorbic acid. Standard curve was prepared using suitable volumes of standard solution in place of sample. It has been used a series of 6 standard solution within the approximate range of 0,01 to 2,0 mg P/l. After 10 minutes and before 30 minutes absorbance was measured at 880 nm using a reagent blank as a refrence solution.

## Results and discussions

The distribution of available P concentration in AL solution is influenced by the type of soil.

| Soil type | 0-20 cm | | 30-45 cm | |
|---|---|---|---|---|
| | pH | P(ppm) | pH | P(ppm) |
| Albic luvisoil | 5.75 | 45.39 | 5.40 | 27.4 |
| Clay-illuvial brauwn soil | 6.60 | 14.24 | 6.10 | 10.78 |
| Pseudogleic | 4.70 | 21.96 | 5.75 | 16.59 |
| Psamosol | 8.15 | 20.24 | 8.70 | 15.61 |
| Gleic | 5.70 | 32.9 | 6.95 | 15.53 |
| Alluvial | 6.35 | 30.05 | 6.15 | 16.87 |
| Brauwn eumezobazic | 6.35 | 19.00 | 6.45 | 6.89 |
| Brauwn luvic | 6.12 | 25.38 | 6.30 | 16.43 |
| Typical clay-illuvial chernozom | 5.40 | 36.58 | 5.75 | 22.37 |
| Lacoviste cambica | 5.45 | 33.45 | 6.10 | 16.83 |
| Amphigleic | 4.70 | 31.63 | 5.75 | 19.92 |
| Typical cambic chernozem | 5.01 | 30.48 | 5.75 | 16.15 |
| Typical redish brauwn | 6.50 | 10.52 | 6.35 | 3.85 |
| Solonetz | 6.55 | 27.96 | 8.0 | 19.05 |
| Vertisol | 6.50 | 32.76 | 6.65 | 13.81 |

The above analyses demonstated that there is a difference between the P content at 0-20 and 30-45 cm depth. The higher P conc in top soil samples is related to fertilizer application, soil organic watter content and soil P recycled through the plant residues. Agricultural P imput to 30-45 cm depth has been associated with P anionic retention on clays and their subsurface inovement.

P content 30-45 cm soil depth reveals structural and morphological differences between analysed soil.

Albic luvisoil, typical clay-illuvial chernozem, amphigleic and solonet soil characterized by high clay content 32,13%, 33,45%, 29,52% and 33,01% respectively have an abnormal high P concentration 27,4 ppm, 22,37 ppm, 19,92 ppm and 19,05 ppm.

A possible explanation may be fixation of P in acidic soils on reactive forms of Fe and Al (as hydrated oxides and Al and Fe bauind to organic watter) and leaching.

$$AlO(OH) + H_2\,PO^-_4 \qquad AlO(H_2PO_4) + OH^-$$

$$FeO(OH) + H_2\,PO^-_4 \qquad FeO(H_2PO_4) + OH^-$$

The transport of phosphorus (related too to soil acidity) vom albic luvisoil, typical clay-illuvial chernozem, amphigleic and solonetz can contribute to entraplication of groundwater.

## Conclusions

The transport of phosphorus by leaching was demonstrated by its high concentration 30-45 an depth.

The soils with high clay content (albic luvisoil, typical clay-illuvial chernozom, amphigleic and solonetz) favorize the mavement of this soil imobile chemical element.

P concentration is related to acid soil pH at 30-45 cm depth.

Albic luvisoil, typical clay-illuvial chernozom, amphigleic and solonetz present majer risk of P contamination underground water.

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