Seasonal variation of soluble phosphorus influenced by agricultural practices

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CONTEXT

- Phosphorus (P) is an essential element for plant nutrition. The total reserve of phosphorus in the soil is generally very high, but only a very small fraction is directly available to the plant (soluble P – Pw); the major part is fixed and immobilized in the soil. The different forms are in equilibrium depending on soil conditions (soil moisture, temperature, pH, surface chemical properties).

- Mineral fertilizers are usually added to increase P availability. However, world reserves of mineral phosphorus are limited and non-renewable at human scale. The disappearance of phosphate rock of high quality is expected in the coming decades → Other agronomic practices are needed in order to increase the efficiency of mobilization of P present in soil.

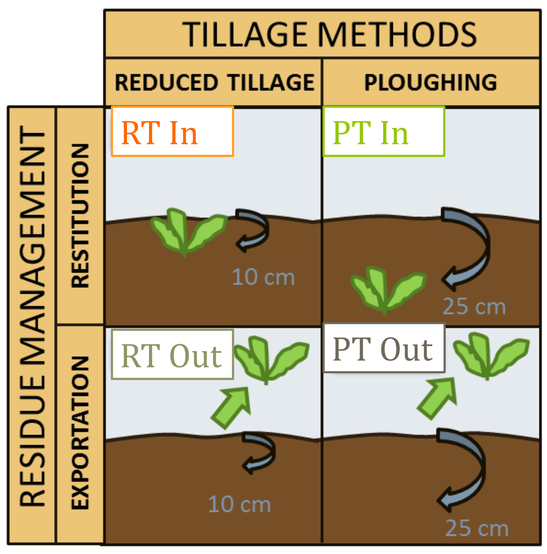
- In that context, **the objective** of this research is to study the influence of tillage and crop residues restitution on seasonal variations of P soluble within topsoil.

METHODS

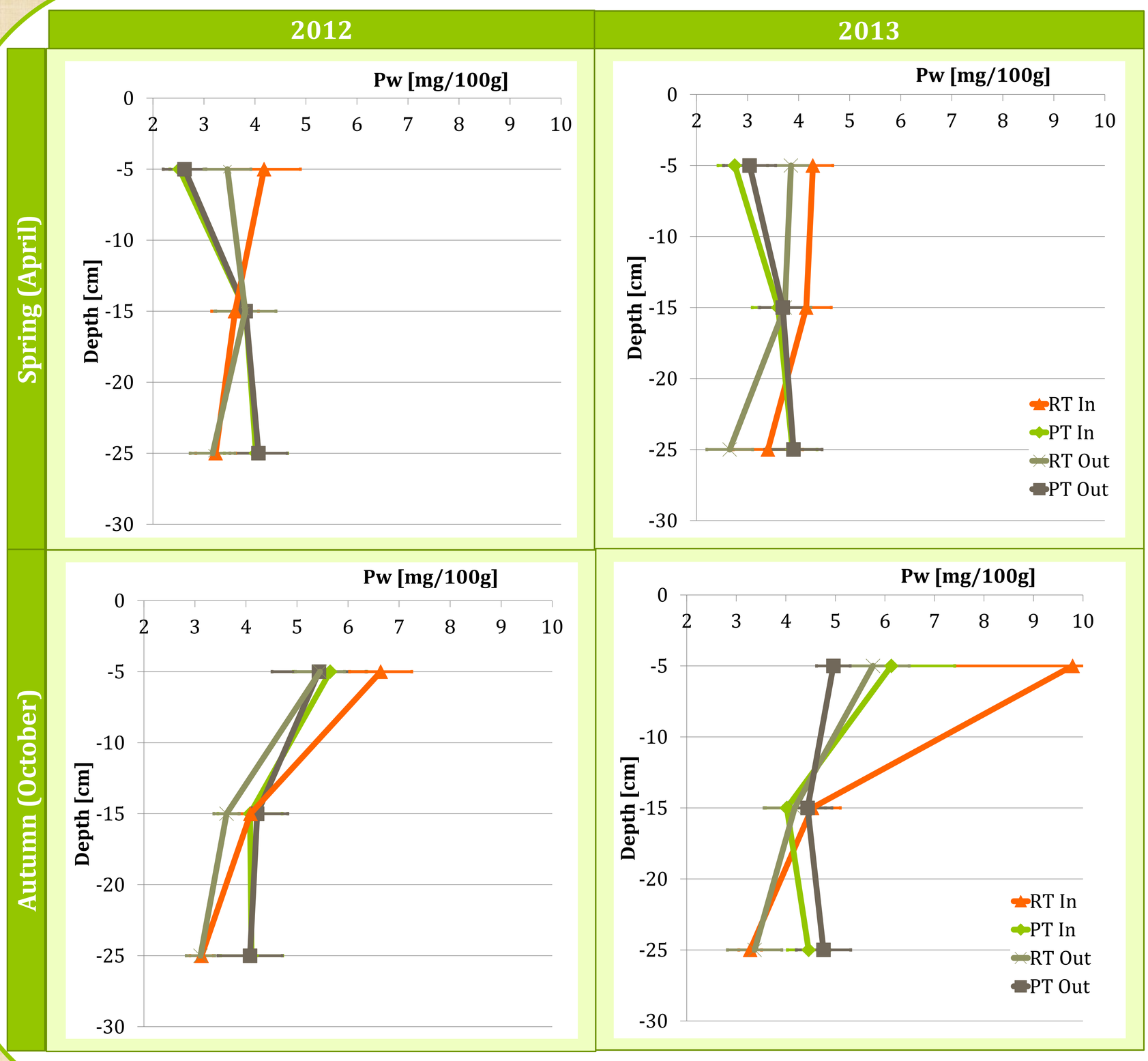
Experimental Field
- Since 2009
- Silty soil
- 4 modalities

Soil Sampling
- 0-10, 10-20 & 20-30 cm
- Twice a year

Chemical analyses
- Soluble & available elements, HWC
- TOC, pH KCl



RESULTS & DISCUSSIONS



Spring

- Pw content is higher at the soil surface and then decreases under PT while the trend is reversed under RT
- Soluble Ca (Caw) and Mg (Mgw) contents increase with depth regardless tillage treatments (not shown)
- A negative correlation occurs between Pw and Mgw (not shown)
- Pw (RT In) > Pw (RT Out) → effect of crop residues restitution. Actually the decomposition of crop residues left on the field constitute a source of P. This cannot be observed under ploughing because of a bigger dilution of the residues in the soil

Autumn

- Pw is higher at the soil surface and then decreases with depth regardless tillage practices
- Caw and Mgw contents are higher at the soil surface and decrease with soil depth (not shown)
- Pw and available P (not shown) contents within topsoil are higher in autumn than in spring → mineralization is more important in autumn (% of soil humidity higher)
  The opposite trend is observed for Caw and Mgw (not shown) → negative correlation with Pw

CONCLUSIONS

- Soluble P content is significantly different depending on the season probably due to better conditions for the mineralization process in autumn (humidity and temperature). The variation of soluble Ca and Mg contents with the season depends on the soil humidity content.
- Pw content is negatively correlated with soluble Ca and Mg in autumn and only with soluble Mg in spring → Suspicion of immobilization of P due to equilibration between elements
- In spring, the distribution of soluble P content is influenced by tillage practices which is not the case in autumn.
- The crop residues left on field decompose and constitute a significant source of soluble P.