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Oxygen isotopes and P cycle in the soil/plant system: where are we heading?

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Phosphorus (P) is a major nutrient for all living organisms. In the terrestrial environment, P is a double-edged sword. For this reason, a better understanding of P cycling in the soil/plant system and the processes influencing its transfers and transformations is needed to provide agricultural and environmental managers with better concepts for P use. In fact, whereas the effect of abiotic reactions on the P concentration in the soil solution are well understood, we still know too little about the forms of soil organic P, and about the importance of soil biological processes (e.g. on organic matter mineralization-immobilization, or on the role of microorganisms) in controlling P availability.

Together with more traditional and routine analysis for P, in the last 20 years researchers have started using the ratio of stable oxygen isotopes in phosphate (δ^{18}O-P) to investigate P cycle in the soil/plant system. The scientific community interested in using this isotopic tracer is expanding because δ^{18}O-P has proven to provide important information on biological processes. A large part of the published studies has shown how δ^{18}O-P can be used to track P in the environment, providing information on P transfer from one pool and/or sink to the other. The other part has used this tool as a tracer of biological activity, clarifying how P is cycled through the microbial biomass or by plants. Together with a short review of the most relevant published results, we will discuss whether, and under which conditions, the δ^{18}O-P can be applied to study P cycling and transformations from the process to the ecosystem level.