



Relevant role of dissolved humic matter in phosphorus bioavailability in natural and agronomical ecosystems through the formation of Humic-(Metal)-Phosphate complexes

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Natural Organic Matter (NOM) and the NOM fraction present in soil solution (dissolved organic matter: DOM) are currently considered as fundamental actors in soil fertility and crop mineral nutrition. Indeed, decreases in crop yields as well as soil erosion are closely related to low values of NOM and, in fact, the use of organic amendments as both soil improvers and plant growth enhancers is very usual in countries with soils poor in NOM. This role of NOM (and DOM) seems to be associated with the presence of bio-transformed organic molecules (humic substances) with high cation chelating-complexing ability. In fact, bioavailable micronutrients with metallic character in soil solutions of alkaline and calcareous soils are forming stable complexes with DOM. This beneficial action of DOM also concerns other plant nutrients such as inorganic phosphate (Pi). Among the different mechanisms involved in the beneficial action of DOM on P bioavailability, the possible formation of poly-nuclear complexes including stable chemical bonds between negative binding sites in humic substances and Pi through metal bridges in soil solution might be relevant, especially in acidic soils. In fact, several studies have proven that these complexes can be obtained in the laboratory and are very efficient in prevent Pi soil fixation and improve Pi root uptake. However, clear experimental evidence about their presence in soil solutions of natural and agronomical soil ecosystems has not published yet. We present here experimental results supporting the real presence of stable Pi-metal-Humic (PMH) complexes in the soil solution of several acidic soils. The study is based on the physico-chemical characterization (³¹P-NMR, FTIR, TEM-EDAX, ICP-OES) of the DOM fraction isolated by ultrafiltration from the soil solution of several representative acidic soils. In average, more than 60 % of Pi was found in the soil solution humic fraction forming stable humic-metal (Fe, Al) complexes.