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# Physico-chemical changes in dissolved organic matters in the rhizosphere of plants grown in soil amended with organic wastes: an in-situ investigation.

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In agricultural context, prerequisite condition to forecast trace metal phytodisponibility is to evaluate trace metal speciation in the rhizosphere solution, especially in soil amended with organic wastes. The most advanced trace metal speciation models (e.g. WHAM, NICA-DONNAN) take into account dissolved organic matter (DOM) reactivity toward trace metals. Generally, the scientific community uses, a fixed percentage of DOM reactivity, usually of 40 % to 80 %, to predict trace metal speciation. However, recent studies have demonstrated that the binding capacity of DOM towards trace metals is much larger than expected. The aim of our study was to investigate the mechanisms supporting the variability in DOM reactivity by assessing the physico-chemical changes of DOM in the bulk-soil and rhizosphere in context of agricultural recycling of organic wastes.

An in-situ experiment was conducted in Reunion Island (Indian Ocean). Two plant species, i.e. a graminaceous species the fescue (Festuca rubra) and a dicotyledonous species the tomato (Lycopersicon esculentum), were grown on a soil where we applied two types of organic wastes (pig manure compost and poultry manure compost) at three rates and a mineral fertilizer. Following this experiment, the soil either adhering to the roots (i.e. rhizosphere) or not (i.e. bulk-soil) was sampled and the soil solution was recovered by chemical extraction. DOM concentration, total acidity and DOM fluorescence were measured.

Root activities and organic wastes induced variations in the physico-chemical parameters of DOM. DOM concentration tended to increase in bulk-soil with increasing organic waste application rate. DOM concentrations measured in rhizosphere are significantly greater than those in the bulk-soil especially when organic wastes were applied to soil. Preliminary results allow us to observe a decrease in the density of carboxylic-like ($pKa<7$) sites, after organic waste application as well as in the rhizosphere of the two crop species. Three-dimensional fluorescence measurements allowed to identifying three fluorescent components of terrestrial humic-type. A slight increase in the fluorescence intensity in the bulk-soil after organic waste addition and in the rhizosphere compared with the bulk soil was observed, especially for soils that have received the highest dose of organic wastes. The changes in fluorescence intensity, and consequently in DOM quality, suggests changes of the complexing capacity of the components constituting DOM. To our knowledge, this is the first results supporting the qualitative changes in the physico-chemical properties of DOM after the application of organic wastes and a confirmation of the evolution of the DOM in the rhizosphere due to root and microbial activities.

These preliminary results demonstrate the need to consider influences of the DOM reactivity toward trace metal speciation. Further DOM characterizations should enable us to confirm these hypotheses and to assess the impacts of these changes on the complexing ability of DOM toward trace metals and consequences on trace metal phytodisponibility.