

Effect of citrate on phosphorus availability in soils with contrasted mineralogy - a modelling approach

Marek Duputel^{1*}, Nicolas Devau¹, Michel Brossard², Philippe Hinsinger¹, Benoît Jaillard¹, Frédéric Gérard¹

¹INRA (UMR Eco&Sols),

²IRD (UMR Eco&Sols) 1 place Pierre Viala, 34060 Montpellier, France

marek.duputel@supagro.inra.fr

Aims and Background

Plants can exude large amount of carboxylates which ultimately increase phosphate (P) availability. Both anions compete for adsorption onto soil minerals. Mechanistic modelling approach can be profitably used to understand these competitive interactions in soils. The aim of this study was to use such an approach to investigate citrate effect on P desorption in soils of contrasted mineralogy.

Methods

As Devau et al., 2011a, three adsorption models were used to simulate citrate and P competition onto the major sorbents of the studied soils; 1-pK Triple Plane, simple ion exchange and Nica-Donnan. Tested citrate concentrations were representative of those found in the rhizosphere. We considered a large range of pH values.

Results

At high citrate concentration (100iM), the larger increase of P availability was found at high pH in Luvisol and Chromic Cambisol and at low pH in Ferralsols. At lower citrate concentration (10iM), the maximum increase was predicted at acidic pH in Ferralsols. Surprisingly, a decrease of P availability was calculated in Luvisol and Chromic Cambisol.

Conclusion The extent of P desorption is a function of citrate release, soil pH and mineralogy. Predicting the effect of citrate on P availability requires to account for the interactions with clay minerals, not only Fe oxides.

Reference

Devau N, Hinsinger P, Le Cadre E, Colomb B, Gérard F (2011a) Fertilization and pH effects on processes and mechanisms controlling dissolved inorganic phosphorus in soils. *Geochim. Cosmchim. Acta.* 75:2980-2996.



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