Rhizosphere processes influencing phosphorus cycling in soils with low and high P availability

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Background: In managed agroecosystems, and natural ecosystems dominated by annual plants, understanding the influence of rhizosphere priming in soils with different P availability and speciation will provide information to help better predict how management practices (i.e., conservation tillage, cover cropping, etc.) and succession in natural and disturbed ecosystems influence C, N and P cycling. The aim of this study was to investigate the role of rhizosphere processes in inducing P cycling and its effect on plant growth in agricultural soils with low and high P availability and different P speciation.

Approach: Corn plants were grown inside the greenhouse, and soil samples were collected from bulk and rhizosphere at different vegetative growth stages. A variety of biogeochemical parameters measured such as microbial biomass, potential enzyme activities, phospholipid fatty acid, and solution ^{31}P NMR.

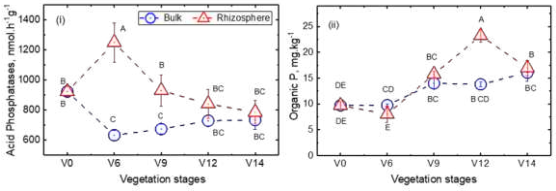

Figure 1: Acid phosphatase enzyme activities (i) and concentration of organic P (ii) in bulk and rhizosphere soils of low P content at different vegetative growth stages of corn plant. Different letters indicate significant differences among acid phosphatase enzyme activities (or Po concentration) with vegetative growth stages and soil regions combined ($P < 0.005$).

Result and discussion: In low P soil, P deficiency resulted in an increase in the potential acid phosphatase enzyme activiy at early vegetation stages, a decrease in the organic P (Po) fraction (Fig. 1) and a shift in microbial community composition resulting in greater plant uptake of P. The overall findings from this study highlight the importance of Po sources in low P soils and the tight coordinaton between micorbes and plants necessary for increasing Po utilization.