Root exudate composition and its role in rhizophere priming and phoshporous cycling

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Background: Rhizosphere priminng is tightly coupled with nutrient availability. It is generally suggested that P limitations do not lead to rhizosphere priming because C and P cycling are considered to be decoupled. The aim of this study was to test how root exudate composition influenced priming and P cycling in soils with greater and lesser P availability, concentration and different P speciation.

Approach: Isotopically unique alanine, oxalate, and glucose were delivered through an artifical root to soils with high and low [P] in specially constructed rhizoboxes. Acid phosphotase activity was imaged via zymography, O_2, CO_2, and pH were imaged using planar optodes, changes in organic P and C speciation were determined using ^{31}P NMR and UHR-FTICR-MS, respectively, microbial community composition assessed using PLFA and microbial utilization of exudates assessed using compound specific phospholipid characterizaton.

Results and Discussion: The type of root exudate had a distinct influence on the distribution and concentration of potential acid phosphotase activity in low P soils (Figure 1). We expect this difference to be less in the soils with greater inorganic P availabiilty and to differ between the exudates used based on their effectiveness as a substrate for microbial gowth and their predicted mode of action for P acquisition. Compound specific phoshplipid characterization will determine which microbial biomarker groups utlized the different exudates and NMR and UHR-FTICR-MS will detect changes in organic P speciation and SOM composition. Together these anlyses will ascertain the influence of root exudate composition on decomposition of soil organic matter (i.e. priming) and its contribution to phosphorus cycling.

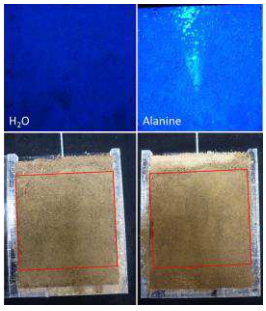

***Figure 1** : Zymographs showing the 2D distrubiton of acid phosphotase around an artifical root delivering Alanine relative to the control box receiving water only (top images) and the rhizoboxes showing the region used for imaging (red box bottom pictures).*