Grassland Fabaceae grown under contrasted phosphorus supply induced changes in rhizospheric soil phosphatase activity

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Theme 1 – Phosphorus forms, availability and cycling in soils

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Keynote presentation

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Grassland Fabaceae grown under contrasted phosphorus supply induced changes in rhizospheric soil phosphatase activity

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Fabaceae performances in low fertility agro systems rely on their capacity to acquire phosphorus (P) since their growth is highly limited by P shortage. Recent work conducted on grassland's legumes demonstrated, that different roots strategies exist within fabaceae family resulting in a large range of responses to P stress. Our objective is to evaluate to what extend rhizospheric soil phosphatase activity is related to Fabaceae response to P limitation. In that purpose, we grew in a green house, 13 grassland Fabaceae species under two levels of P availability for more than 100 days. At harvest, rhizospheric soil were sampled then analysed for alkaline phospho-monoesterase activity together with bulk soil (control). Results show a significant effect of plant on species identity on rhizospheric phosphatase activity, *Anthylis vulneraria* and *Vicia cracca* induce high phosphatase activity in their rhizsospheric soil while *Securigera varia* and *Trifolium pratense* induce low phosphatase activity. There is also a significant and negative effect of P supply on phosphatase activity of rhizospheric soil. The activity measured for the bulk soil is always significantly lower than the one measured for the rhizospheric soil. It was interesting to notice that phosphatase activities measured for Fabaceae are not different from those obtained for Poaceae grown under similar conditions. We showed that Fabaceae species induce au strong increase of the phosphatase activity in their rhizospheric soil in comparison to bulk soil. However, further work is needed to understand the link between rhizospheric soil activity and P stress tolerance.

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A simple technique for studying root hair development under varying levels of buffered P supply

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Root hairs contribute significantly to phosphorus (P) uptake and are particularly important when P supply is low and strongly diffusion-limited, which is the case for many depleted and P-fixing soils in the tropics. In view of the need to select and develop P-efficient crops, it may be of interest to explore genotypic variation in root hair development. However, the measurement of root hair development of soil-grown plants is difficult as root hairs are easily damaged while roots are washed out from soil. Growth pouches or hydroponics have been used to study root hair development but in these systems it is not possible to spatially buffer P supply. A method was developed to evaluate root hair growth under artificial conditions that closely mimic diffusion-limited P supply in soils. The method involves seedlings grown on an agar medium that contains P adsorbed on Al_2O_3 nanoparticles at different levels of P intensity. The use of Al_2O_3 nanoparticles as P buffer ensures clarity of the agar, allowing for in-situ measurements of root hair length and density. Results of a study on 8 soybean genotypes screened in both the agar medium and a pot experiment using a P-deficient soil at low and high P supply are presented. P intensity in the agar was buffered at 6 and 80 μM, while total P concentrations in the medium were 120 and 250 μM respectively. The P intensities corresponded to the P concentrations measured in the pore water of the amended soil samples used for the plant growth experiment. We conclude that the technique provides a simple way to study the plastic response of root hairs to P deficiency governed by localized P-sensing mechanisms.