Root functional traits and their plasticity drive grasslands' Fabaceae capacities to face phosphorus shortage

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Keynote presentation

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Root functional traits and their plasticity drive grasslands' Fabaceae capacities to face phosphorus shortage

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Understanding which strategies allow plants to cope with N and P shortages may lead to select species better able to valorize non-optimal growth conditions in agrosystems. This question is of particular importance for Fabaceae since they are able to free themselves from soil nitrogen supply, but are highly limited by P shortage. To test which root strategies allowed species to be more efficient under P shortage we grew, in a greenhouse, 13 grassland Fabaceae species under two levels of P availability. Ten root functional traits were measured, including cross-sectional area occupied by aerenchyma, mycorrhizal rate, root hair length, root phosphorus use efficiency (RPUE), root-surface phosphatase activity, and specific root length (SRL). Traits plasticity in response to P shortage was also evaluated. Results showed a negative relationship between mycorrhizal rates and biomass production in high and low P availability conditions. Long root hairs and high aerenchyma production are associated with high biomass production in, respectively high and low P availability conditions. We highlight that the increase of root-surface phosphatase activity and RPUE in response to P shortage were positively related to biomass production in this condition. Moreover, high SRL, the plasticity of SRL and root hair length in response to P stress limit the impact of this stress on species biomass production. Our results showed that grassland Fabaceae display a broad range of root functional strategies, which drive the different species performances in case of P shortage. Moreover, this study challenges the idea that arbuscular mycorrhizal fungi have always positive effect on plants' growth.