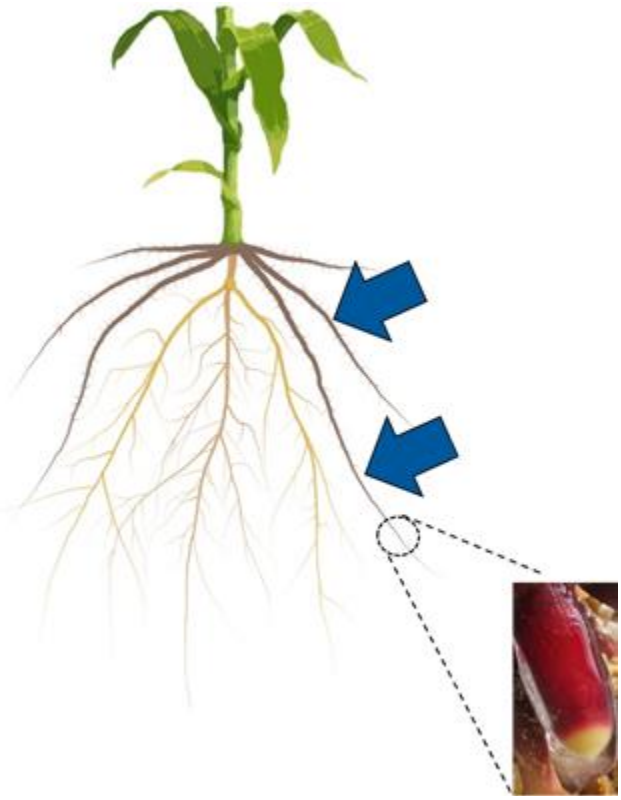
The impact of root exudates on the physical properties of soil and root water uptake

Introduction:



Global population is increasing, and projected consumption is placing unprecedented demand on agriculture for food production. Securing food availability is a major challenge, since global water shortage and degradation are already limiting crop yield today and this limitation, will further intensify as agricultural activities expand to less fertile areas. The rhizosphere, the interface between plant roots and soil, is rich in provides a unique environment for large and diverse types of substances like microbes, including plant growth-promoting rhizobacteria (PGPR) and root exudates. Investigations on the mechanisms by which these substances mediate plant drought tolerance have largely focused on -root/plant interactions and related plant responses to bacteria types. Comparatively, much less is known about the role of root exudates in altering the physiochemical and hydrological properties of the rhizospheric soil that may affect plant drought stress tolerance.

Hypotheses:

This project is aiming on testing the following hypotheses:

1. Root exudates change the pore space of soils and improve the soil hydraulic properties (both wetting and drying), resulting in material that can hold more water and increase residents time of solutes in the rhizosphere

2. Root exudates may improve crop yields, especially in coarse (sandy) to medium (loamy) texture soils, due to either increase in available water in the rhizosphere, and/or due to prolonging the contact of roots with the soil matrix and consequently higher root water uptake and nutrient uptake.

Methods:

Laboratory work on the estimation of soil hydraulic properties for materials treated with different concentrations of root exudates for both wetting and drying processes. In case of a master thesis, the thesis will include quantification of the SHPS based on pore scale considerations or

quantification of root water uptake with a numerical model. In both cases, model results will be compared against the lab measurements.

Supervisors

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