**Indication for decreasing soil hydraulic conductivity**

Three different treatments and four replications:

1. Direct measurements of rhizosphere hydraulic properties are hindered by the dynamic nature of the components involved:
   - root hydraulic changes with ontology
   - mucilage production
   - composition and diffusion are not constant
   - soil water content changes.

   An experimental approach was developed which enables to simultaneously measure radial hydraulic conductance and water retention curve around artificial roots covered with mucilage or modified model substances mimicking individual properties of mucilage.

   The system accounts for the radial geometry of root water uptake.

**Motivation**

- Roots are hypothesized to alter rhizosphere hydraulic properties by release of mucilage.
- Direct measurements of rhizosphere hydraulic properties are hindered by the dynamic nature of the components involved:
  - root hydraulic changes with ontology
  - mucilage production
  - composition and diffusion are not constant
  - soil water content changes.

**Hypothesis**

- Increases water holding capacity
- Decreases hydraulic conductivity
- Extends range of water potential

**Methods – Experimental set-up**

- Soil filled cylinder, height: 60 mm, radius: 25 mm
- Suction induced by an artificial root, 2.3 mm in diameter
- Measuring loss of water with weighing cells placed below the cylinder
- Measuring matric potential with micro-tensiometer

**Determination of effective radial hydraulic conductance and water retention simultaneously**

**Soil mixed with artificial/natural mucilage – homogeneously or locally around the root**

**Possibility to drain and re-saturate the soil column**

**Results – Water retention**

**First experiment**

- Filled up with coarse sand, \( \rho_{sand} = 1.6 \, \text{g/cm}^3 \)
- Three different treatments with four replications:
  1. Distilled water (2) gel with 0.01 g PGA/kg soil
  2. Gel with 0.1 g PGA/kg soil
  3. Gel with 0.3 g PGA/kg soil

**Further experiments**

- Different concentrations of PGA
- Using natural mucilage / other artificial substances
- Using different soil
- Local distribution of mucilage (around the root)
- Using X-ray Computed-tomography for visualization of soil water distribution on small scale (~ 0.5 cm)

**Modeling**

- Determination of effective radial hydraulic conductance by using the model approach of Koooper et al. (2014)
- Validation of the model

**Verification of method**

- Comparison with evaporation experiment according to Peters & Durner (2008)
- Preliminary experiment with different adapted bulk density showed good agreement

**Outlook**

- Gel slows down decrease of matric potential due to higher viscosity
- Indication for decreasing soil hydraulic conductivity
- Water retention curve seems to be less/not effected by gel concentration

**References**


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