Impact of plant mucilage on the retention and flow of water in different soil textures

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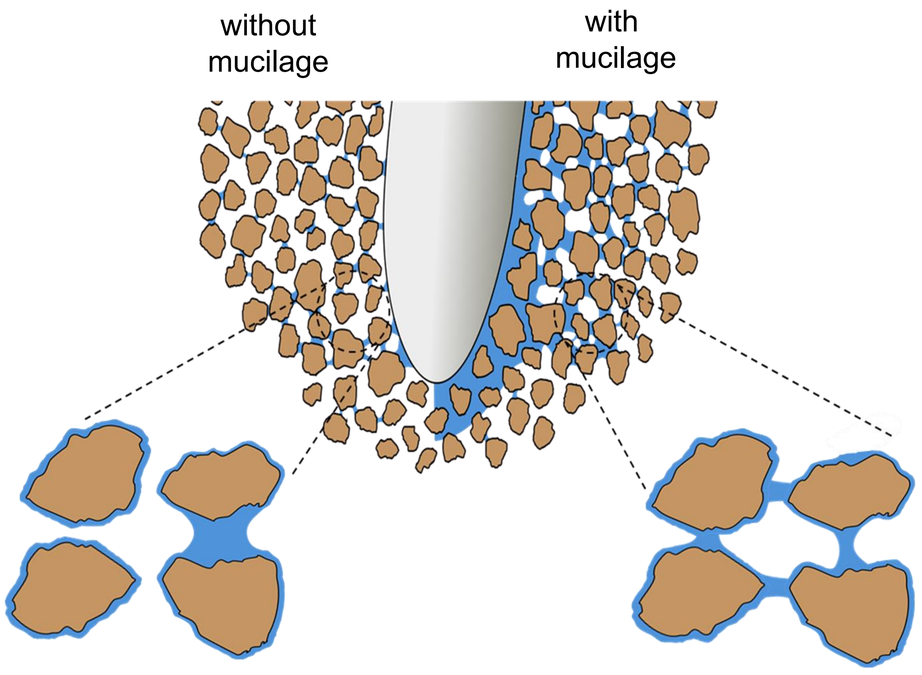
Outstanding Student & PhD candidate Presentation contest

Motivation

- Mucilage is a high-molecular-weight substance exuded by the root tip of many plants.
- It has been shown that Chia seed mucilage increases the **water-holding capacity** and **liquid connectivity** of soils, thereby maintaining higher water retention, hydraulic conductivity, and diffusivity of nutrients in the soil



Objectives

Mechanistically describe the impact of plant mucilage on the soil retention curve and hydraulic conductivity

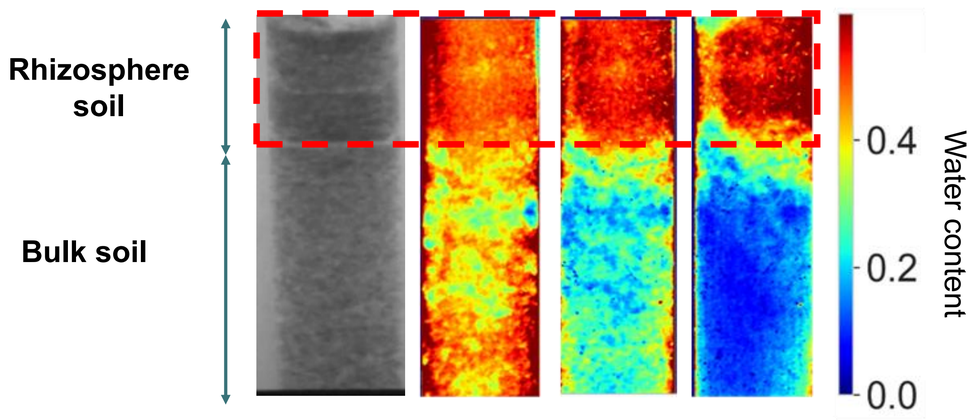
- ➢ In different soil textures
- ➢ Varying soil moisture conditions
- ➢ Different mucilage concentrations

Methods

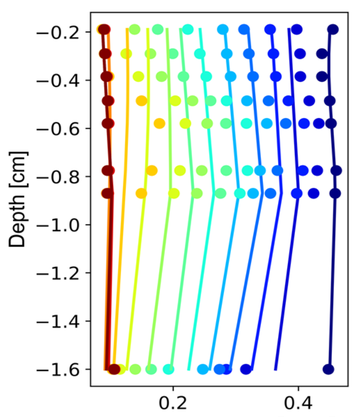
1) Soil texture: Sand (S) & Sandy loam (SL)

2) Maize root mucilage collection **(0, 2.5, 5.0, 7.5 mg dry mucilage/ g dry soil)**

3) Monitoring water content during soil drying by Neutron radiography



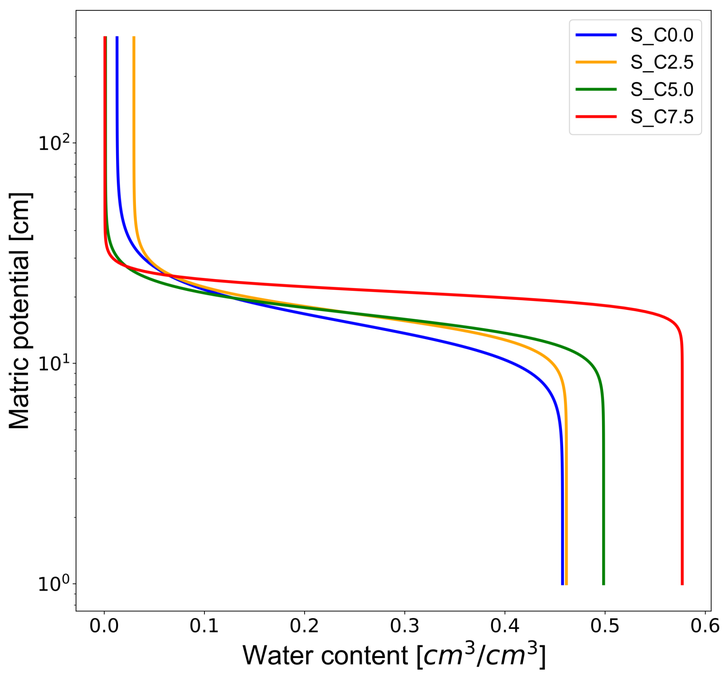
4) Simulation of water flow within soil using the Richards equation, and inverse adjustment of hydraulic properties of the soil to best reproduce soil water dynamics

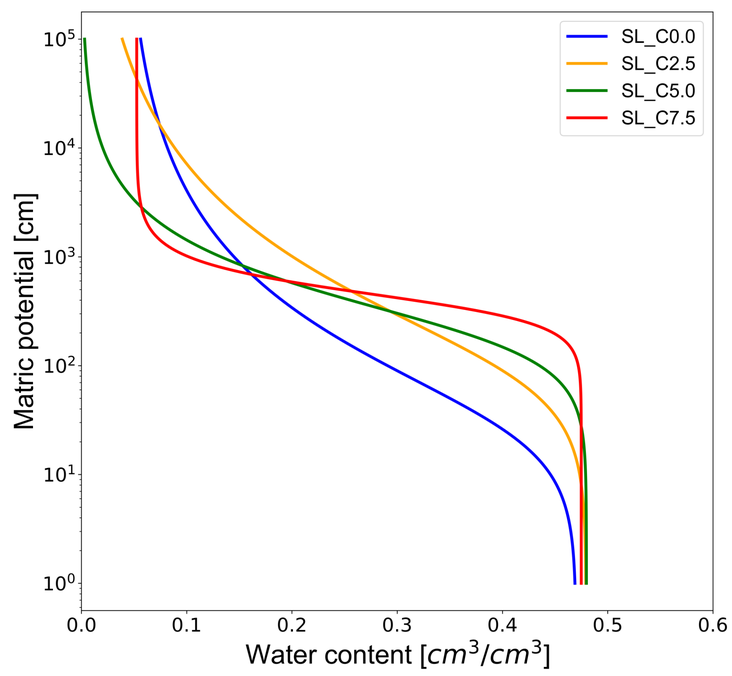


Results

Water retention (soil retention curve)

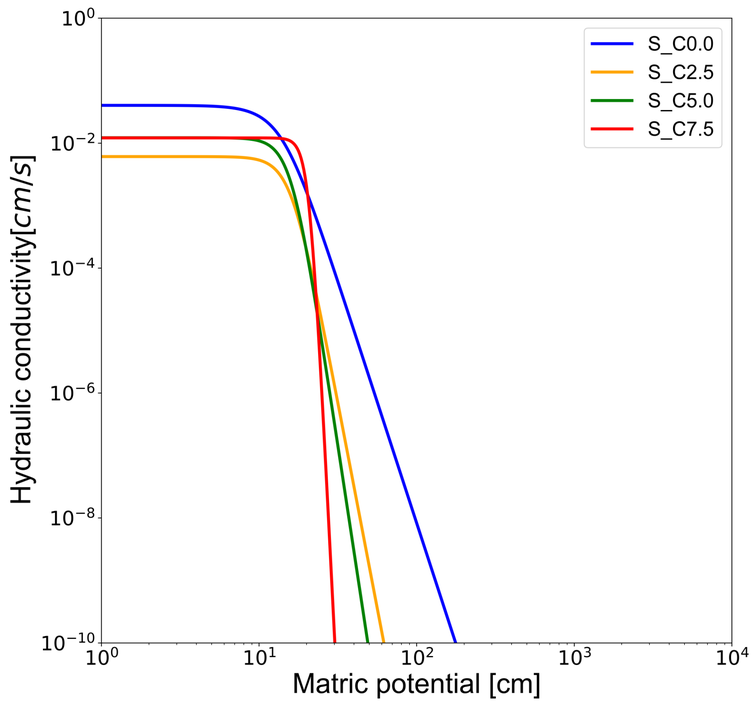
- Water holding capacity increased (in both soils)
- The higher the mucilage content the higher the effect (in both soils)
- Mucilage reduced residual water content due to maintaining the connectivity of the liquid phase
- At the same mucilage content, stronger effects in fine-textured soil (sandy loam) than in coarse-textured soil (sandy)

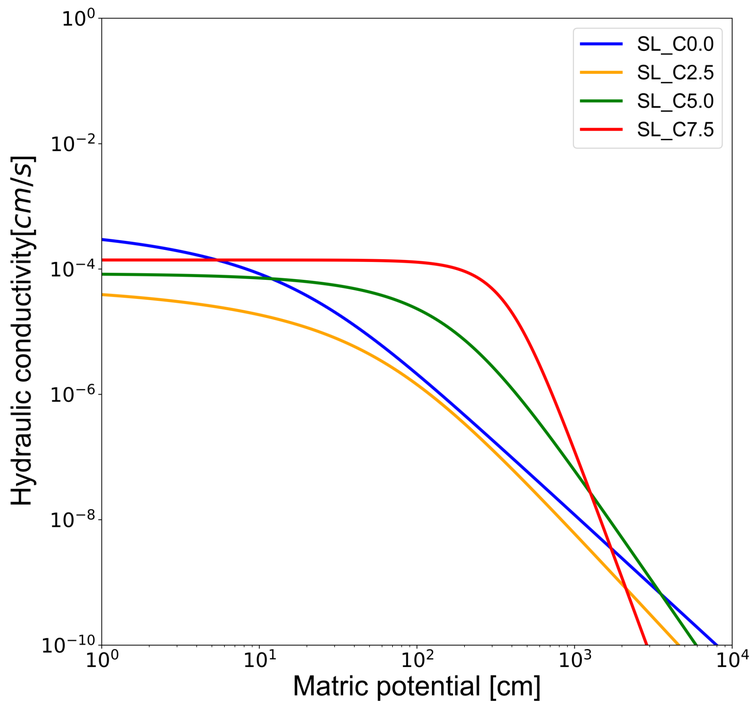




Water flow (hydraulic conductivity curve)

- Sandy soil mixed with mucilage showed lower hydraulic conductivity than the control (viscosity is dominant)
- Sandy loam mixed with mucilage had lower hydraulic conductivity at the wet range (viscosity effect)
- Sandy loam mixed with mucilage maintained higher hydraulic conductivity than control at dry range (liquid connectivity effect)





Take-home message: Retention and flow of water is influentially affected by mucilage. The magnitude of the effect is soil texture and mucilage content dependent.