



Implications of root mucilage on the formation of rhizosheaths

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Introduction

Root exudates stimulate microbial activity and functions as binding and adhesive agent that increases aggregate stability in the rhizosphere. The exudates produced from plant roots and microorganisms in rhizosphere plays a significant role in the formation of rhizosheath. A high viscosity stabilizes soil aggregates in the surrounding of the root and creates rhizosheath. The formation and stabilization of rhizosheath of maize plants under various soil water contents has been studied in the past but the influence of root exudates on the rhizosheath formation associated with other rheological properties still needs to be investigated and understood.

Objectives

- To provide the first combined quantitative data on how root and seed mucilage of different plants affects rhizosheath formation.
- To identify root mucilage rates which can have implications on soil rhizosheath formation
- To identify how the chemical characteristics of different root and seed mucilage behave in different soil types in relation to rhizosheath formation.
- How water contents of soil affects rhizosheath formation under various root and seed mucilage types and concentration.
- How concentration of various root and seed mucilage affects rhizosheath formation during drying and wetting cycles in an artificial root system.

Experimental Design

- In this study three different types of mucilage i.e. chia seed, maize and winter barley will be used
- Flax cords will be used as a model for roots.
- After preparing the soil with mucilage¹, artificial roots will be incorporated in this soil and after drying and wetting cycles roots will be removed.
- The mucilage adhesion, simulation and rheological properties will be investigated under following various conditions i.e. mucilage concentration, soil water content, soil texture, & soil compaction

Concept

- Plant exudates are closely associated with the surface of the solid phase. This contact facilitates exchange of ions between clay particles and plant roots.
- Rhizosheaths comprises the soil that adheres to the roots with the help of root hairs and mucilage even when it is removed from the surrounding soil².



Figure 1: After drying of mucilage, rhizosheath formation

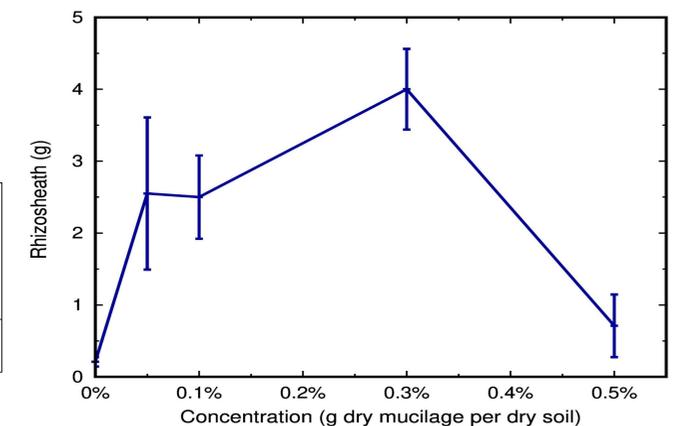


Figure 2: Brace roots of a 5-week-old maize plant secreting exudates

Preliminary Results

Table 1: Measured rhizosheath (g) under various mucilage concentration

| Concentration of mucilage | 0 | 0.05% | 0.1% | 0.3% | 0.5% |
|---------------------------|-----|-------|------|------|------|
| Rhizosheath (g) | 0.2 | 2.55 | 2.5 | 4 | 0.71 |



References

- [1] Ahmed MA, Kroener E, Holz M, et al (2014) *Mucilage exudation facilitates root water uptake in dry soils.* *Funct Plant Biol* 41:1129–1137
- [2] Jenny, H., & Grossenbacher, K. (1963). Root-Soil Boundary Zones as Seen in the Electron Microscope 1. *Soil Science Society of America Journal*, 27(3), 273-277