

The effect of plant mucilage, water content, soil compaction and root tip geometry on root penetration forces in the rhizosphere

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INTRODUCTION

How does plant mucilage affect the penetration force during root growth?
 What are the effects of water content, soil compaction and root tip geometry on penetration force?

OBJECTIVE:

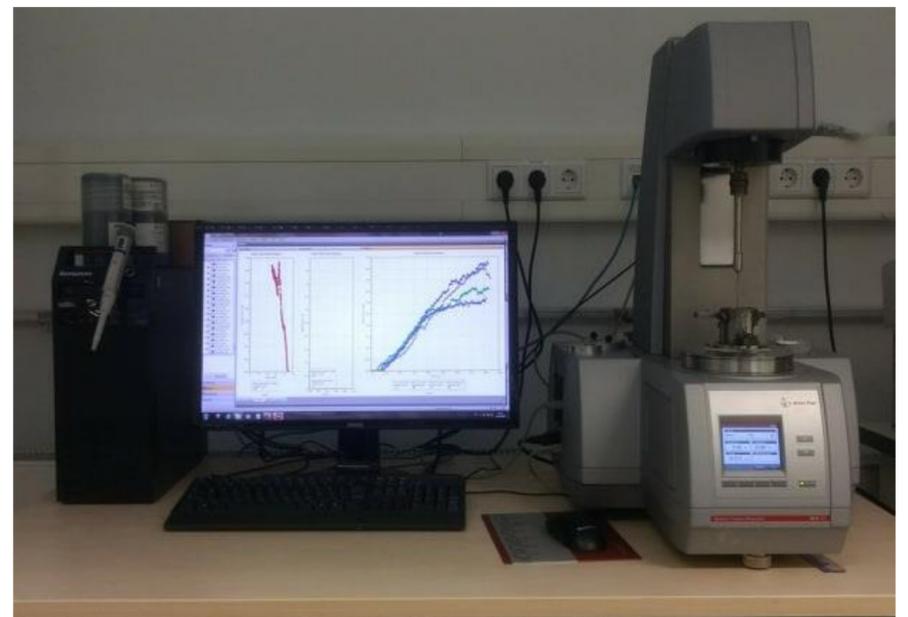
To develop a methodology to vary water content and density of the soil to simulate various field conditions for testing.
 To develop a technique to release root exudates during penetration using an artificial root.

MATERIALS and METHODS

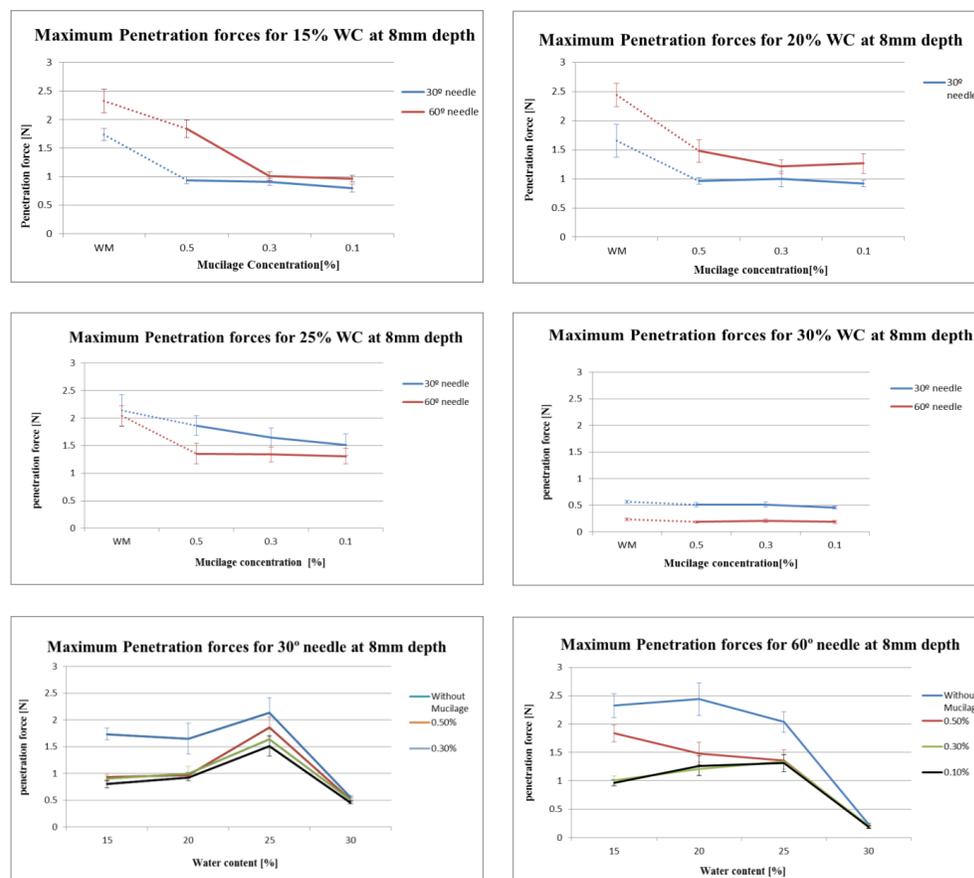
- Fine grained soil with high organic content was **compacted using Mini-Compaction test apparatus** (Sridharan et al, 2005) in mould by free fall of 25 cm of the hammer weighing 1 kg.
- Penetration force** was measured using a **Rheometer apparatus**: Needles of size 0.9×40 mm with apex angle of **30°** and **60°** were used as artificial roots.
- Chia mucilage** of **100µL** concentrations **0.1%**, **0.3%** and **0.5%** were used in this study.
- Finally root growth was simulated by setting **penetration rate** of needle to **40µm/s**.



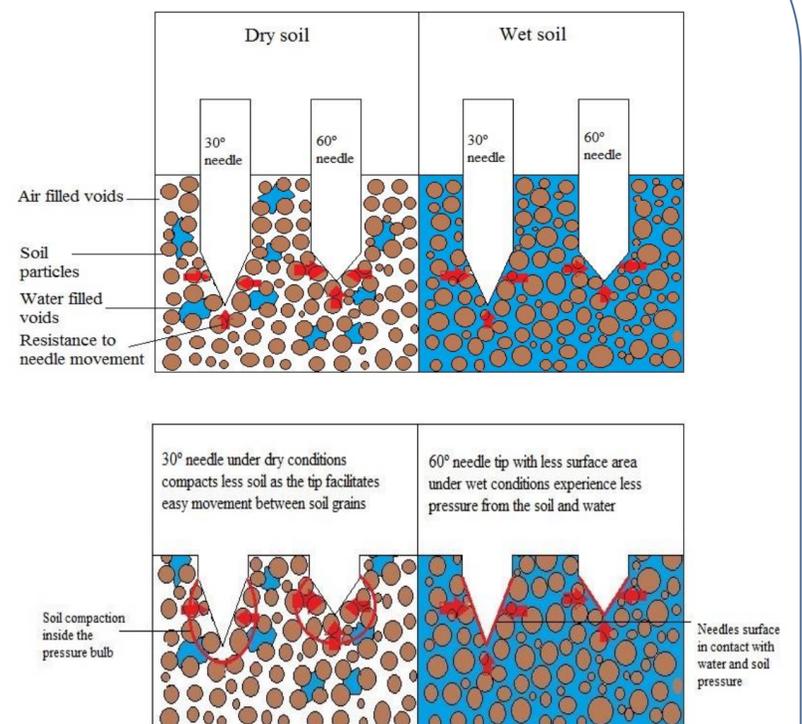
Dash SK et al, 2014



RESULTS



Soil-Water-Root Interactions



CONCLUSIONS

- Penetration forces are significantly affected by mucilage and its concentrations.
- Effect of mucilage is stronger when the soil is dry.
- Water content and the density of the soil also have an effect on penetration forces.
- Root tip geometry affects the penetration resistance significantly.

REFERENCES

- Asuri Sridharan and Puvvadi Venkata Sivapullaiah, "Mini Compaction Test Apparatus for Fine Grained Soils" (2005)
 Sujith Kumar Dash et al, "Behavior of Geosynthetic Reinforced Upaved Roads Under Cyclic Loadings"