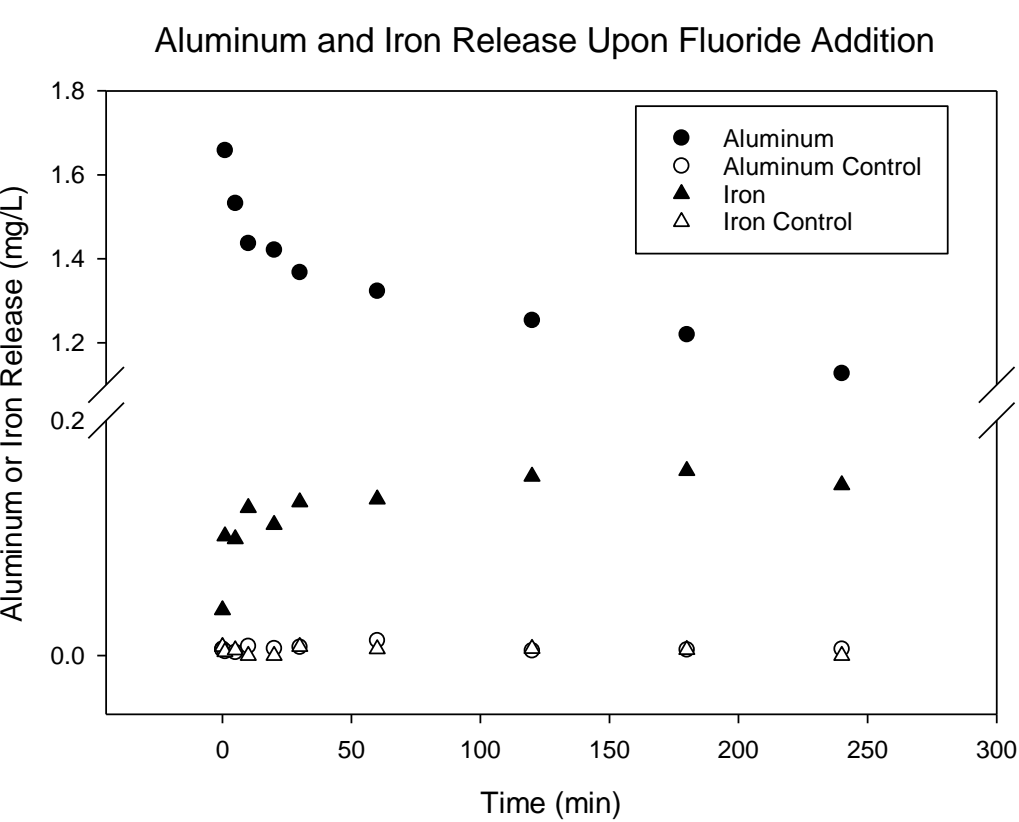
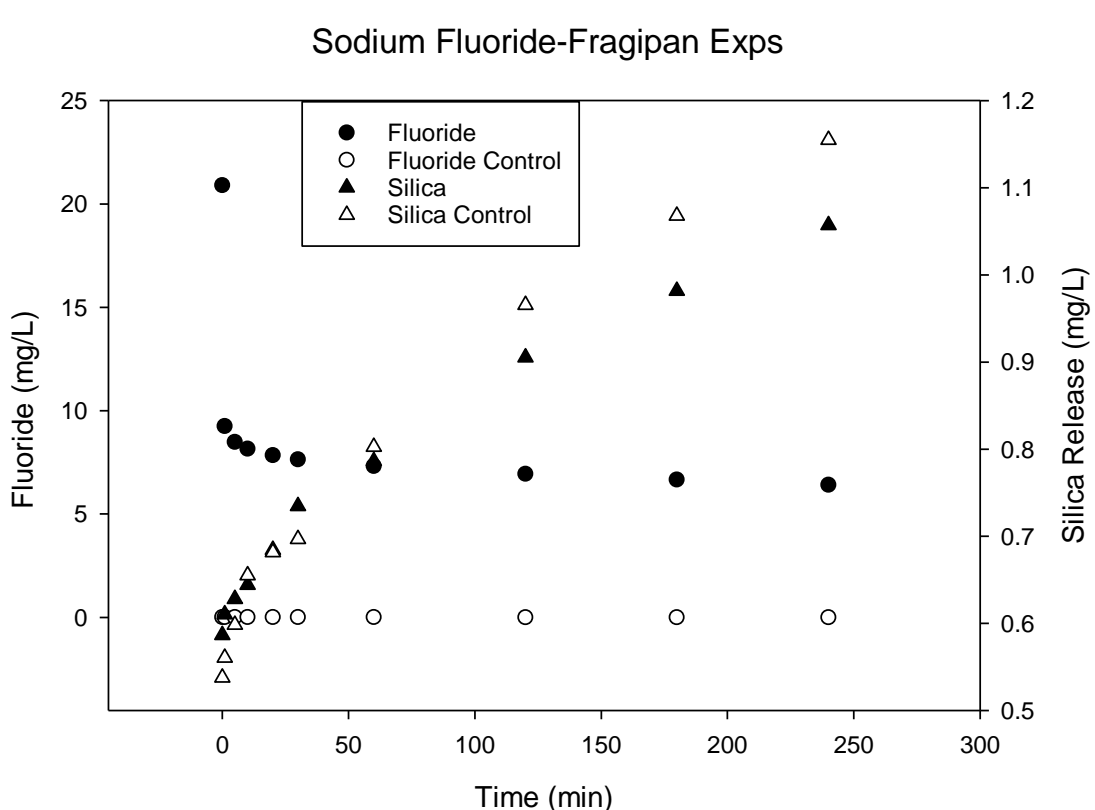
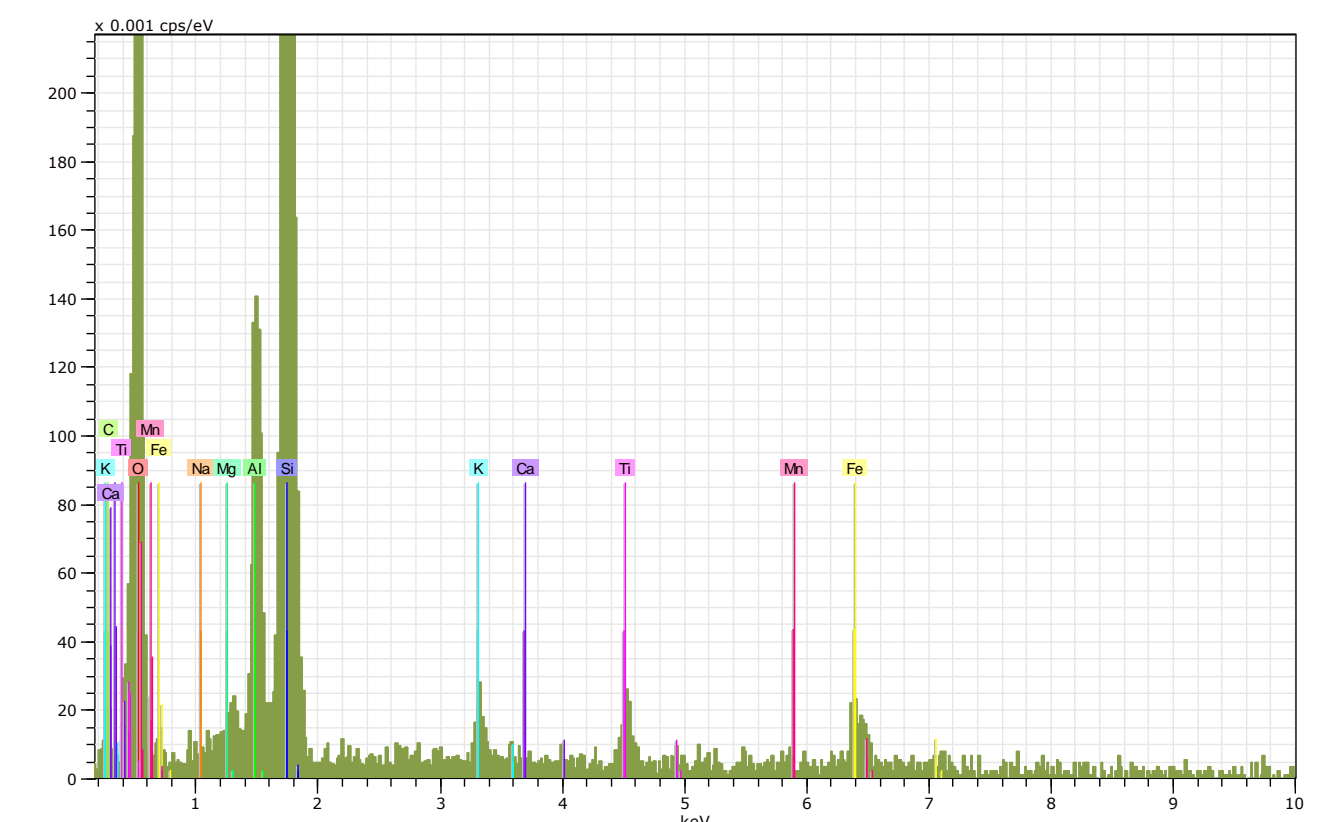
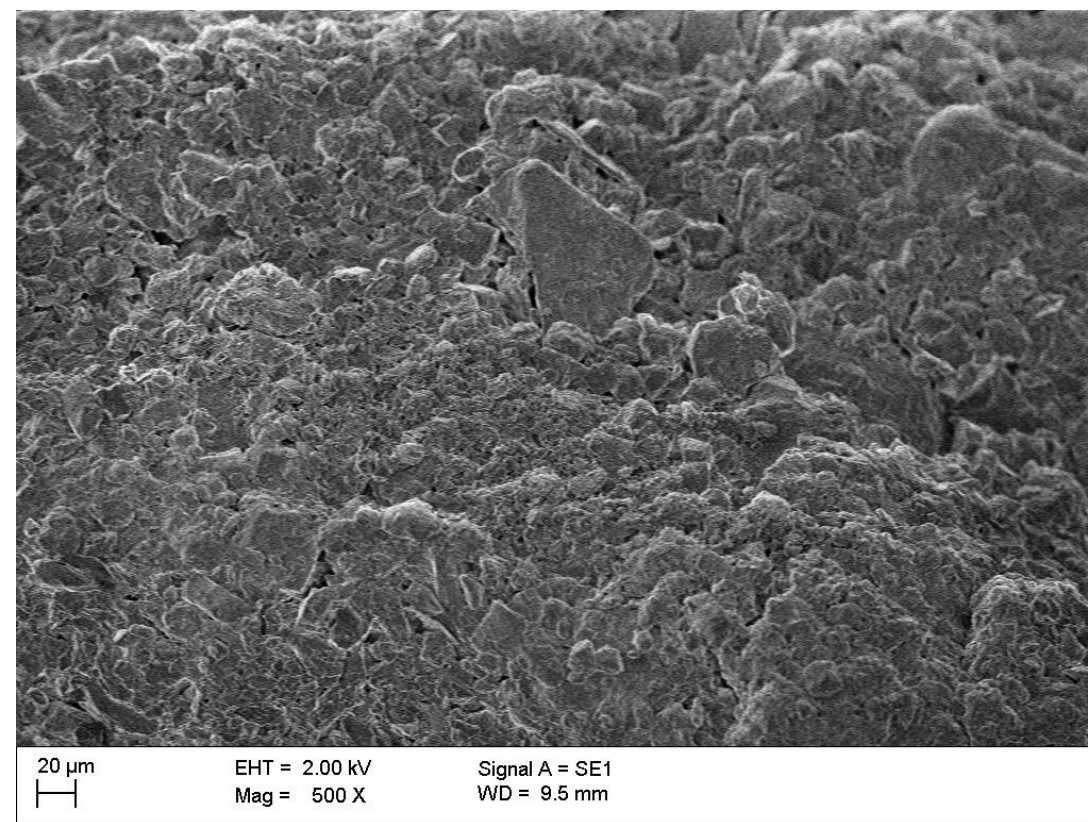


Keegan Smith and Chris Matocha

The Problem

- ❑ Horizons are compact, low porosity (see image) due to Si, Al, and Fe cements
- ❑ Rooting is inhibited
- ❑ Downward water movement is limited
- ❑ Crop growth reduced



Approach

- ❑ Laboratory Experiments
 - 11 different chemical treatments
 - Sodium fluoride (NaF), Na HexP, NaNO₃, potassium chloride (KCl), K₂SO₄ were effective at breaking up fragipan clods
 - 16 different soil amendments
 - Super Cal humate was most effective



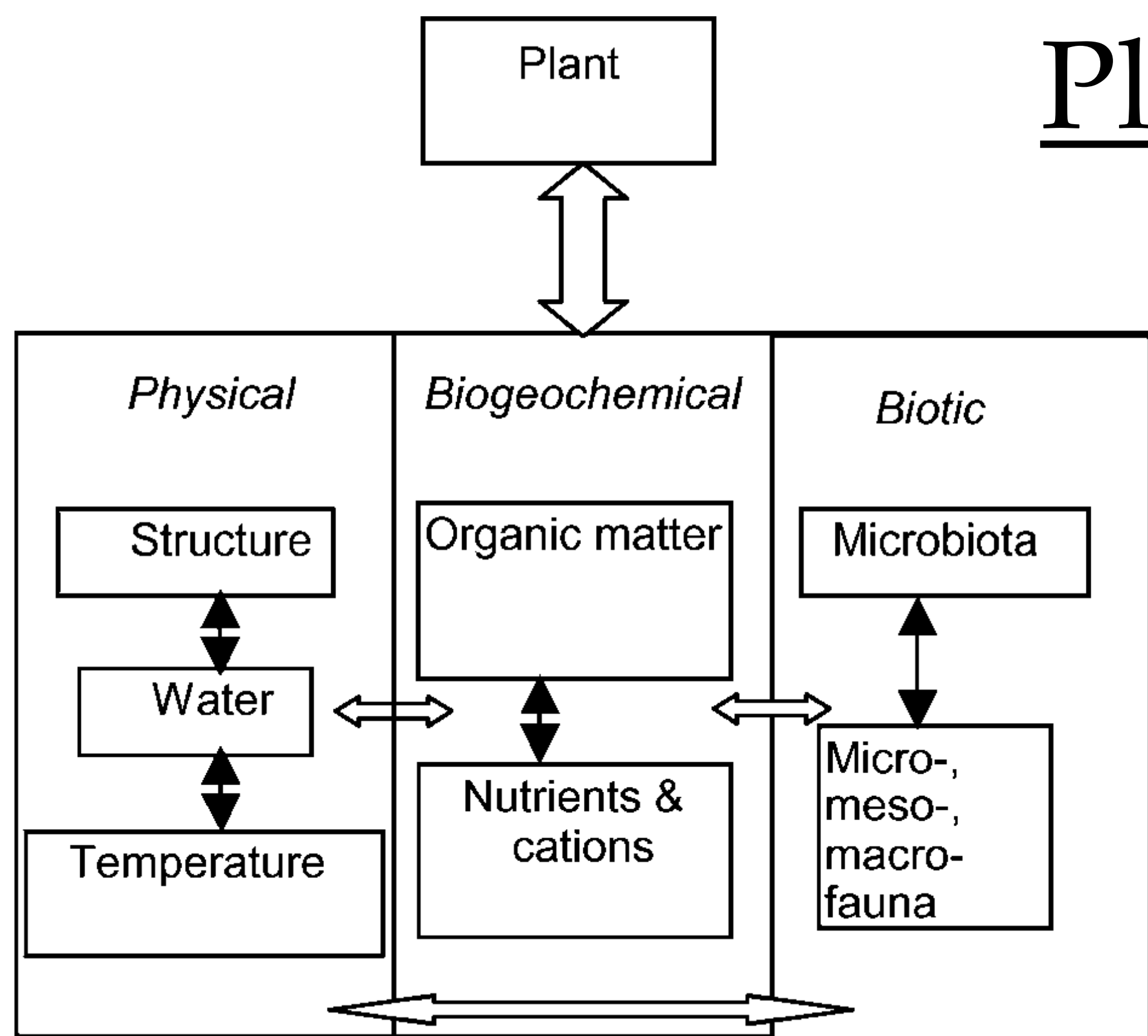
- 7 cover crop treatments
 - Ryegrass outperformed all other cover crops



- ❑ Greenhouse Experiments
 - Grew ryegrass in intact soil cores
 - Bulk density and aggregate strength decreased in ryegrass fragipan horizons compared to control

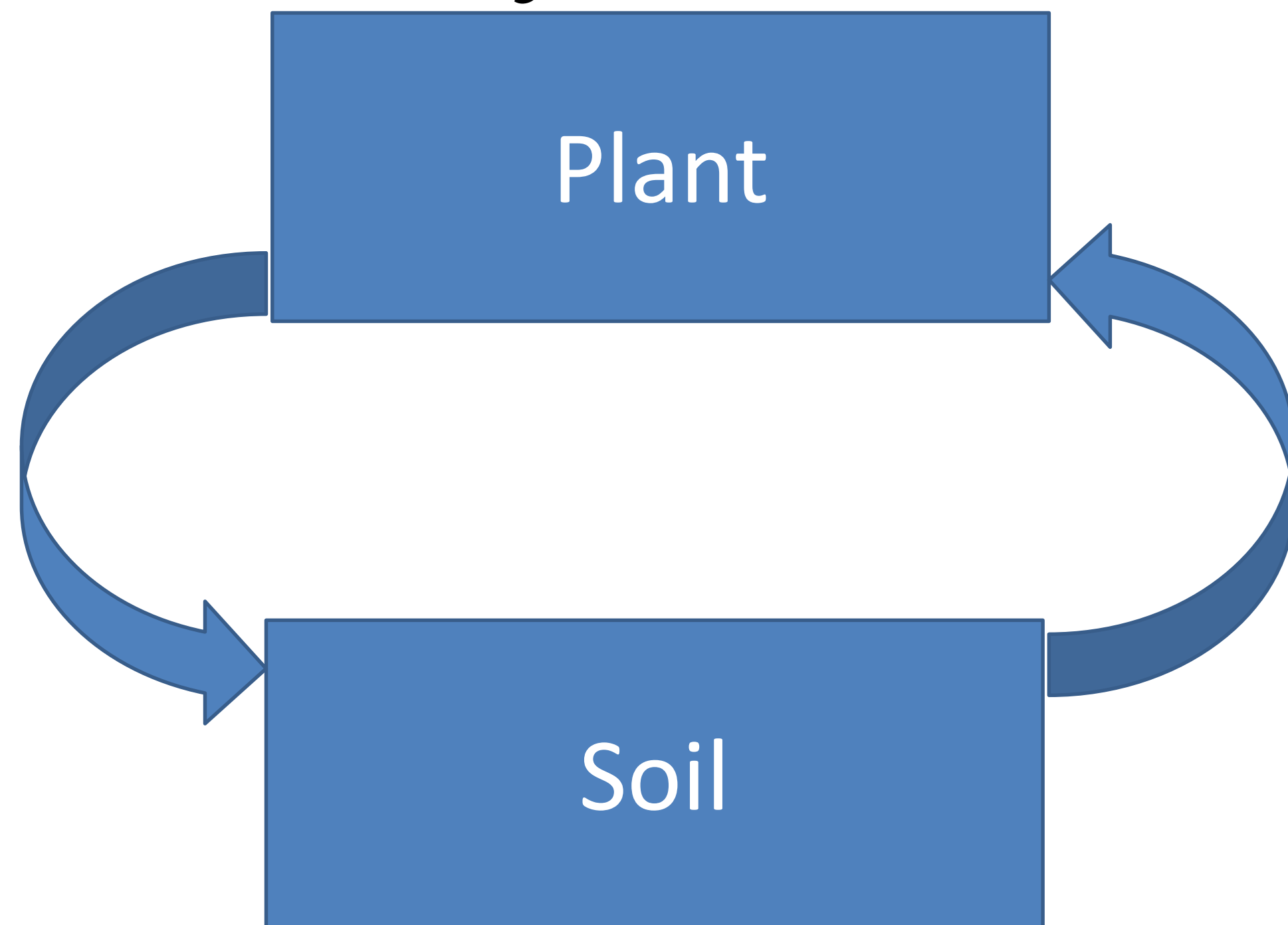
Impact of Ryegrass on

a Fragipan Soil



Soil compartments

Plant-Soil System Feedback



Physical

- ❑ Root drilling
 - ❑ Exert ~100 psi at root tips
 - ❑ Met with physical impedance biologically drill

Fragipan

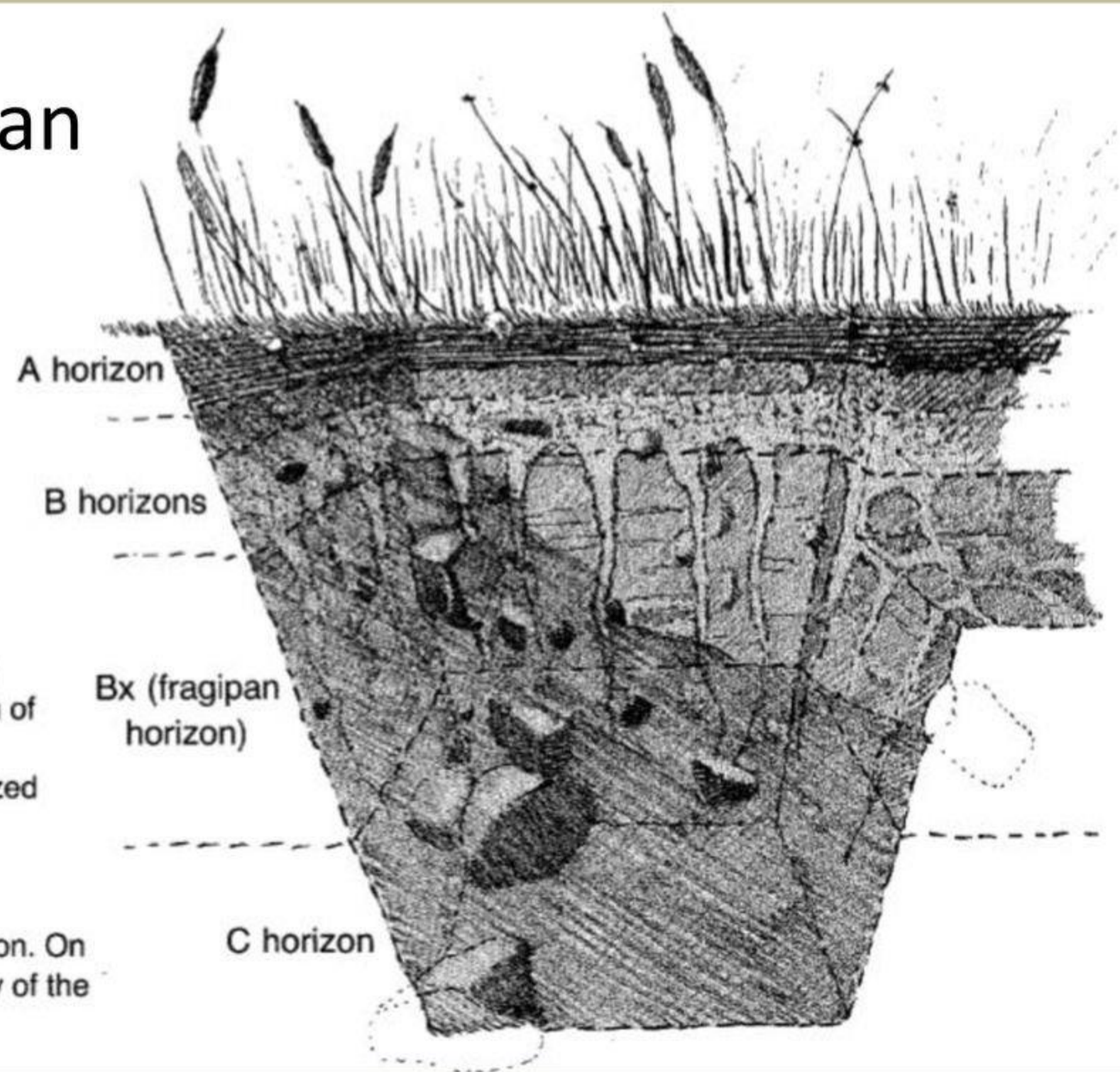


Figure 8.

Soil profile showing a fragipan at the bottom of the B horizon. The fragipan is characterized by bleached vertical streaks which form a polygonal pattern in horizontal cross-section. On the right is a cut-away of the fragipan.

Plate 39 Plant roots grow along the gleyed coating of a fragipan prism whose reddish interior is too dense for roots to grow. The roots are squeezed flat between the prisms.



Chemical

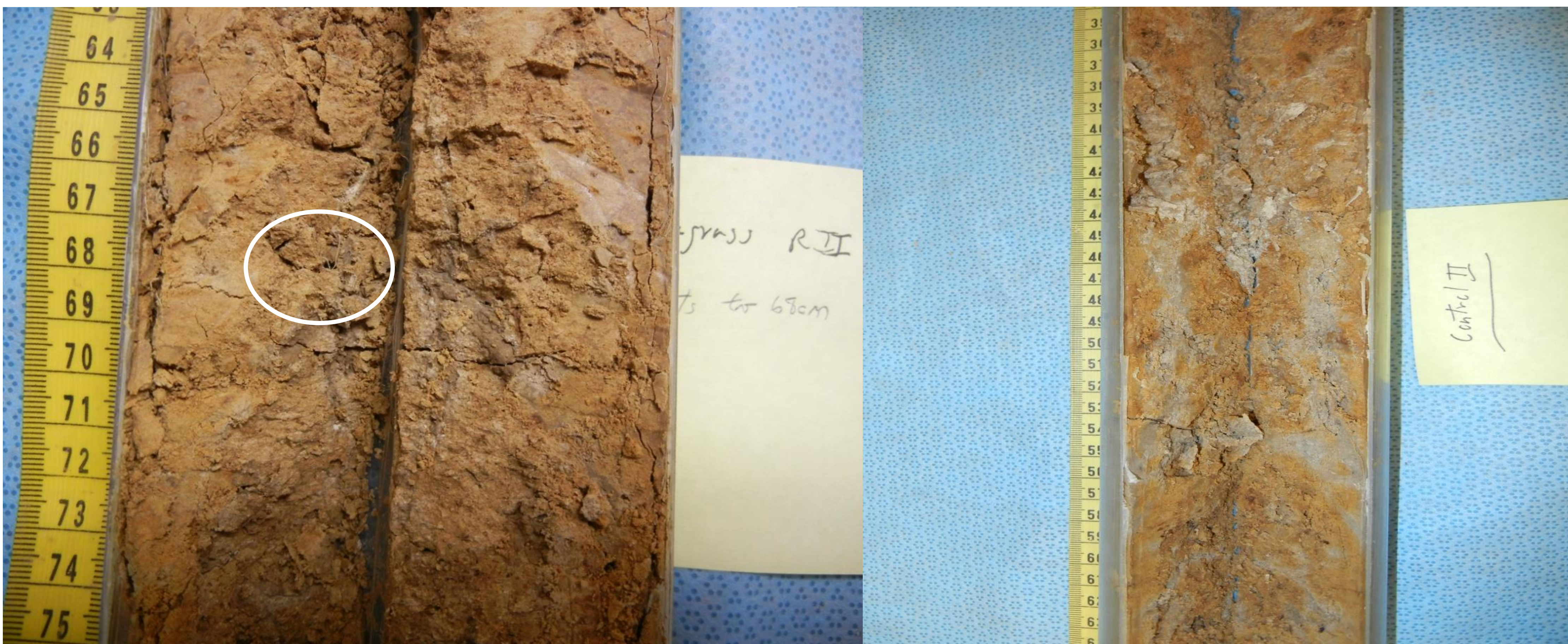
- ❑ Plant root exudates
 - ❑ Secretions (mucilage)
 - ❑ Take C from the atmosphere
 - ❑ Shoots → roots excretions

Impact of Ryegrass on

a Fragipan Soil

Objectives:

- ❑ Evaluate three varieties of ryegrass: Marshall, Bardelta, and Barmultra II and their ability to alter the properties of fragipan without disturbing the soil too much (*in situ*) through greenhouse and lab studies.
- ❑ Investigate the production and reactivity of ryegrass root exudates.
- ❑ Evaluate the role of ryegrass in promoting vertical movement of water in fragipan soils.



Ryegrass rep core with rooting structure at 68cm

Control core

Hypothesis:

Ryegrass roots produce organic root exudates when challenged by mechanical impedance in the soil, leading to the changing porosity in fragipans.

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Acknowledgements

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