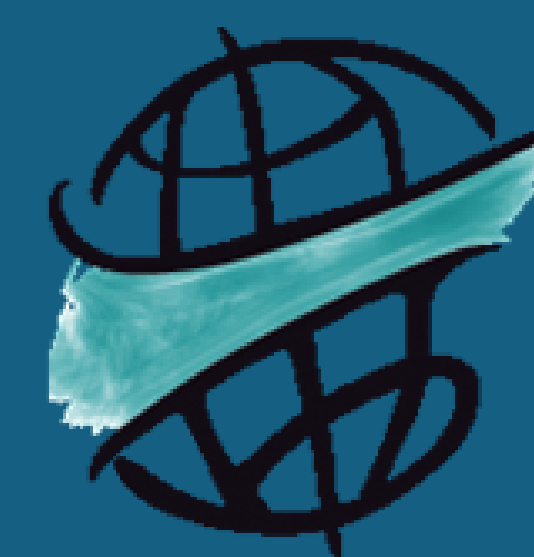




Impact of shade tree species and soil texture on root traits in a cocoa agroforestry system.

-An in-situ root imaging approach-

Klara Kegler¹, Munir Hoffmann¹, Reimund P. Rötter¹, Issaka Abdulai¹



BACKGROUND:

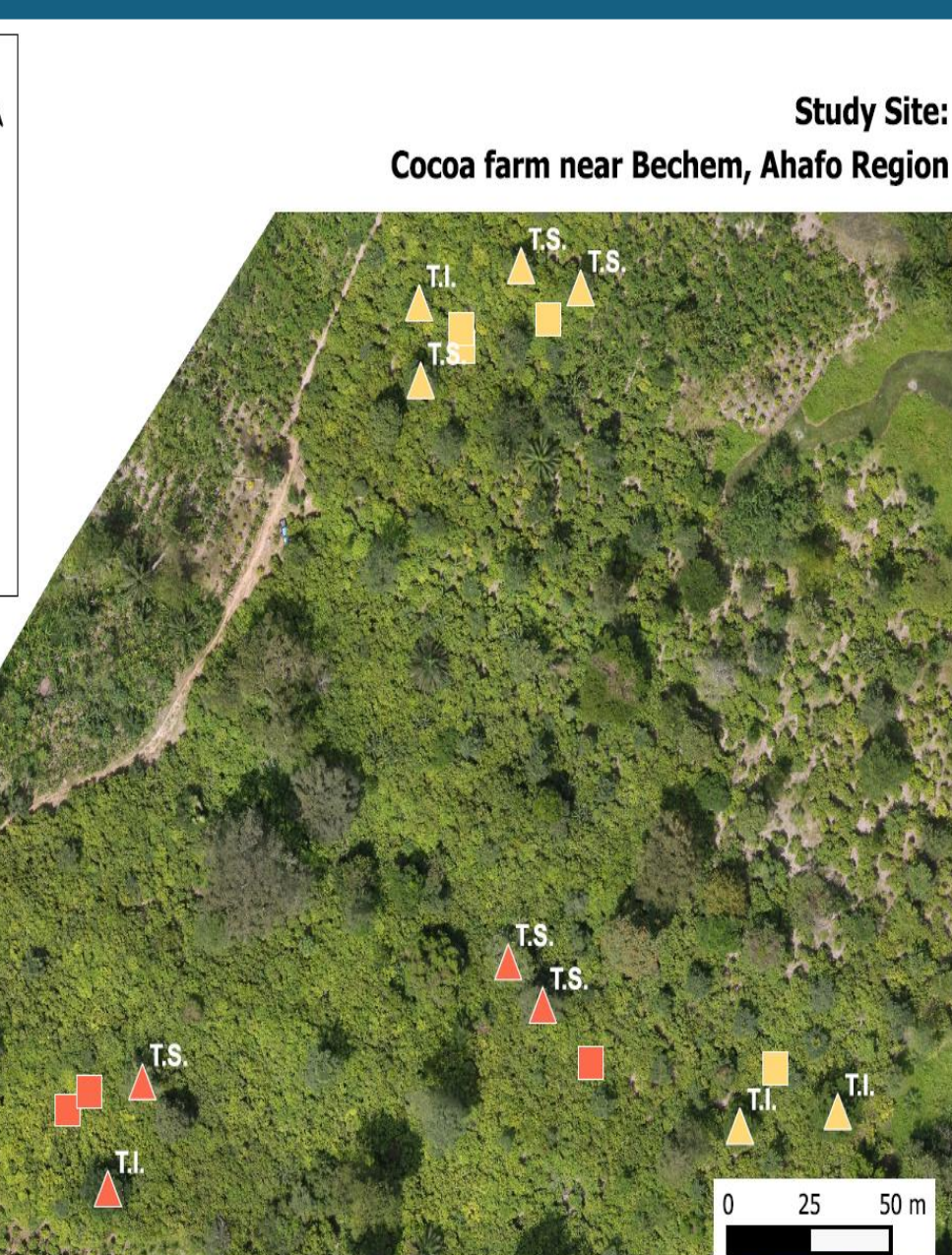
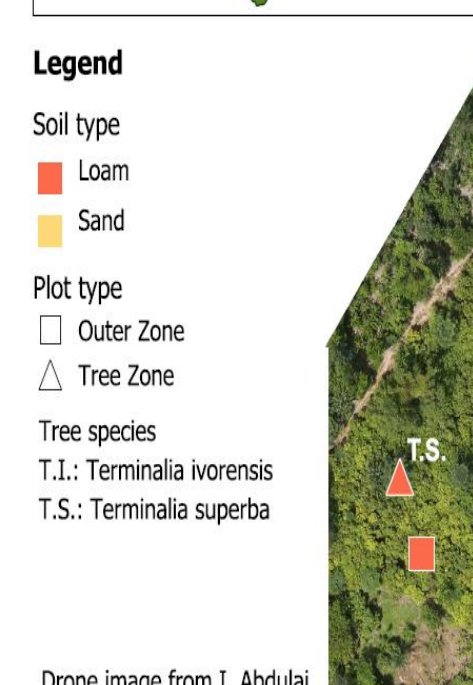
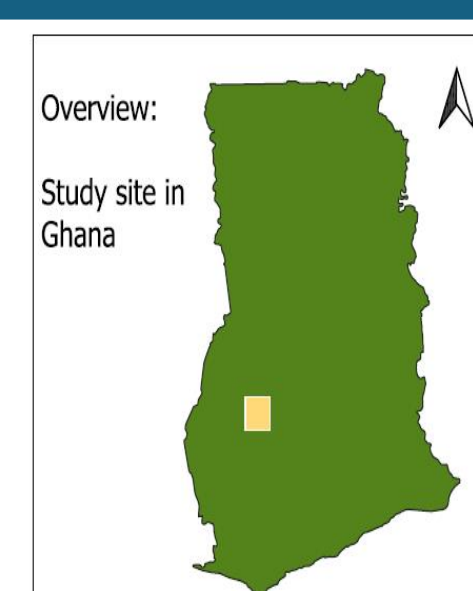
- **Cocoa agroforestry:** traditionally and commonly used but **controversial**.
- Complex tree-crop interactions: benefits (temperature buffer, biodiversity) and conflicts (**resource competition**).
- Sustainable cocoa cultivation requires profound knowledge on **tree-cocoa interaction** under different conditions.
- Roots can provide valuable insights on a **plant's response** to the environment.



AIM OF THE STUDY:

- Evaluate how cocoa roots respond to two shade tree species with different phenology on sandy and loamy soils.
- Quantify accuracy of in-situ root imaging by method comparison.

METHODS:



Plot design:

- 14 „treatment“ plots and 10 control plots
- Soil textures: sand and loam
- Shade trees: *Terminalia ivorensis* (brevi-deciduous after drought), *Terminalia superba* (brevi-deciduous during drought)

I. Root traits data collection:

- Manual root sampling
- Analysis software: WinRhizo 2013



II. In-situ root imaging:

- CI-600 In-situ root imager
- Analysis software: RootSnap!



RESULTS:

I. Root traits under different conditions:

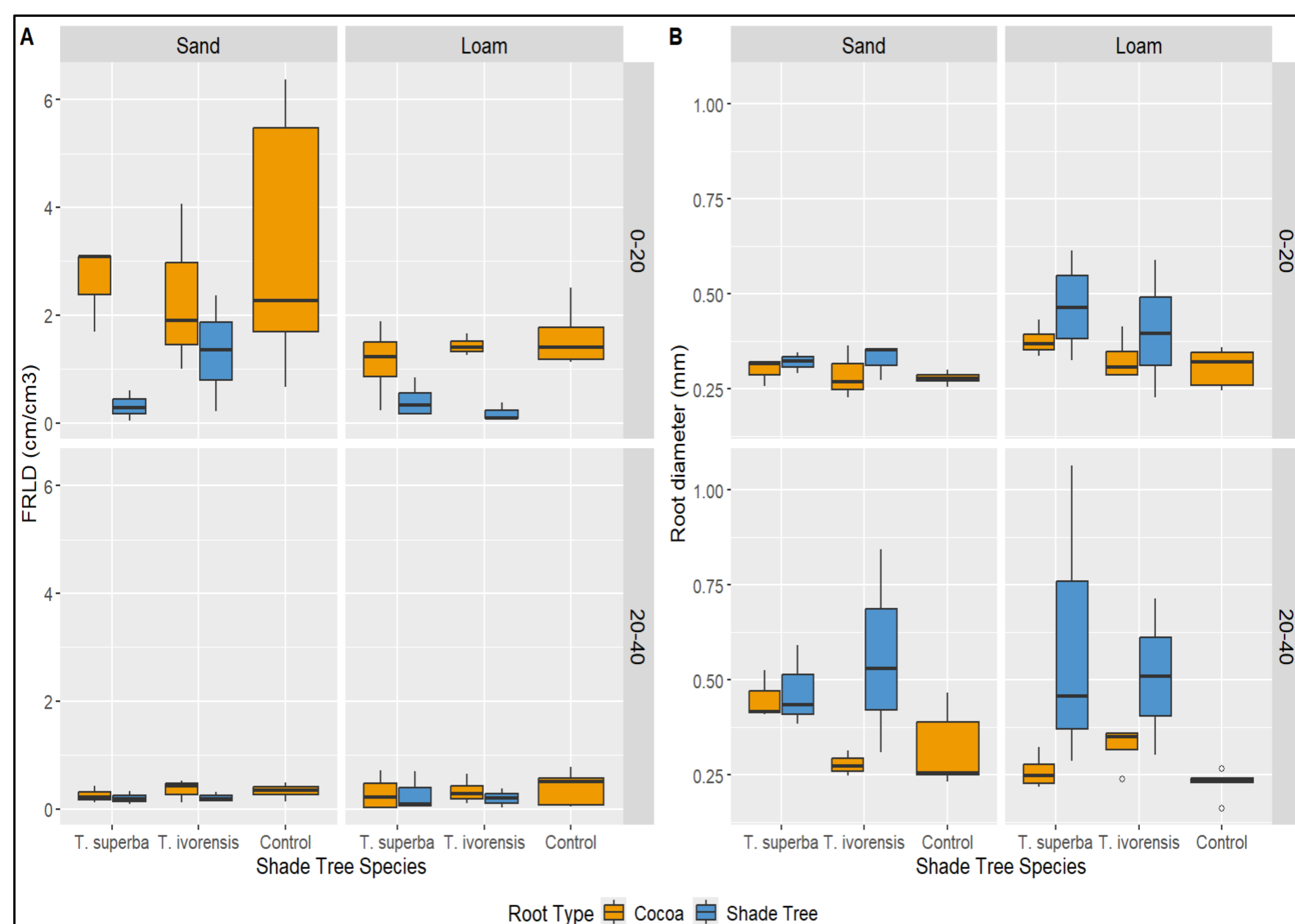


Figure 1: Relation of cocoa and shade tree fine root length density (FRLD) (A) and root diameter (B) across two soil layers and soil types.

II. Method comparison: In-situ Imaging vs. Soil Sampling:

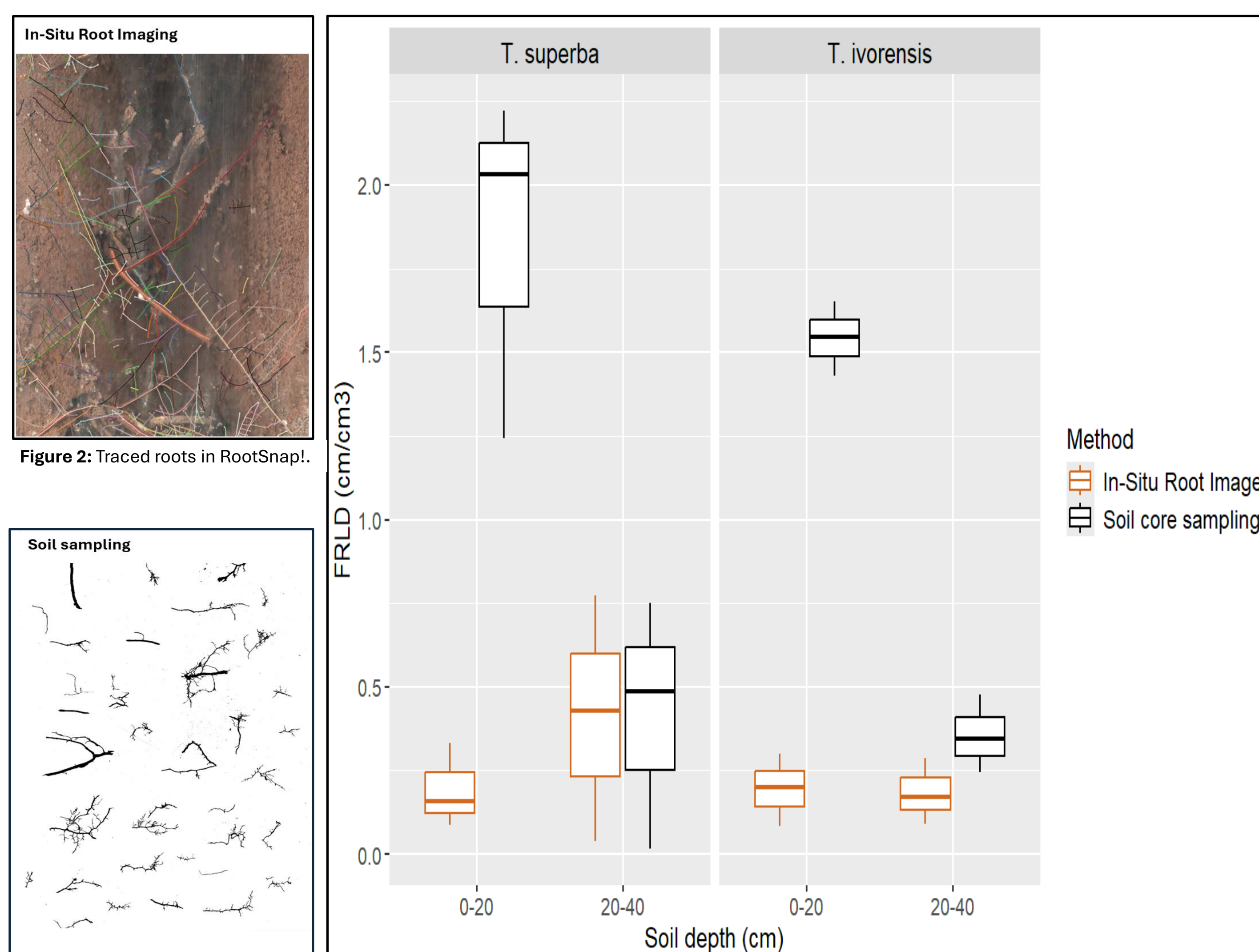


Figure 3: Scanned roots.

Figure 4: Total FRLD with In-situ Imaging method (orange) and soil sampling method (black).

KEY FINDINGS:

I. Impact of soil texture and shade trees:

- Soil texture affects both cocoa and shade tree roots; more non-conservative characteristics in sand.
- Shade trees exhibit more conservative traits than cocoa.
- *T. ivorensis* shows strong response to soil type and might be more competitive with cocoa.

II. Method comparison:

- The in-situ imaging method does not seem representative for root morphological assessments in the upper soil layer.

FURTHER IMAGER APPLICATION: ROOT DEVELOPMENT



Figure 5: Temporal development of *Terminalia superba* roots in loam before, during and after the dry season.

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