

How does agricultural management affect arbuscular mycorrhizal fungal community structure?

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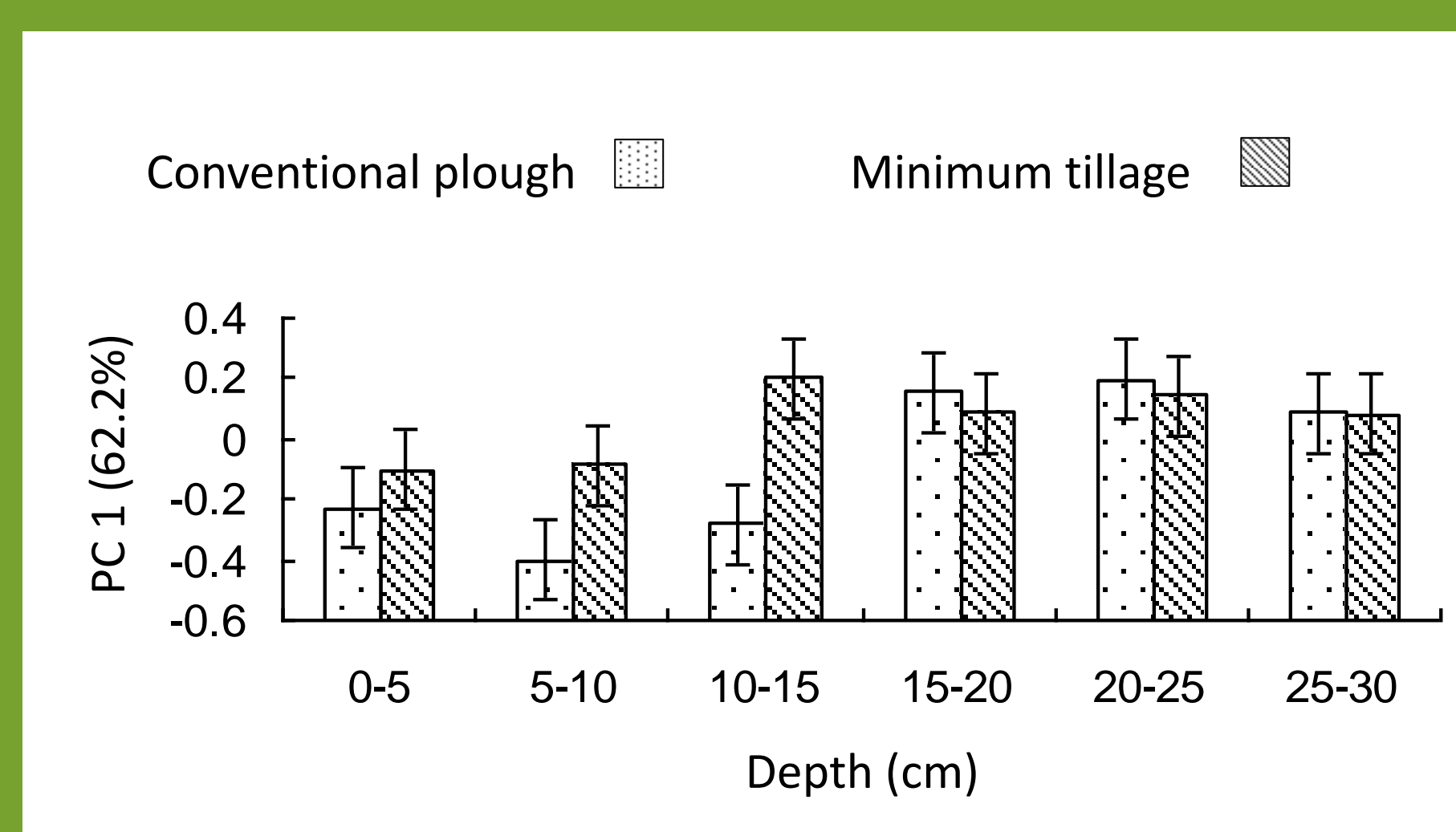
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Introduction

- The arbuscular mycorrhizal (AM) symbiosis offers plants improved nutrient acquisition and resistance to drought and disease in return for supplying the fungal partner with photosynthate
- Reduced-input arable systems support richer communities of AM fungi compared to conventional systems^{1,2,3}
- Preliminary work suggests that differential physical disturbance affects the vertical distribution of AM fungi, with the separation of distinct communities with depth



Relationship between AM fungal community structure and depth with differential disturbance (means \pm S.E.; 3 replicates). Modified from Becker [4].

- We aim to test the hypothesis that the community structure of AM fungi in arable fields can be driven by differential disturbance and that this alters the functionality of the relationship.

Methods

- Soil profiles taken from field plots managed under different tillage systems:
 - Conventional plough (CP)
 - Deep plough (DP)
 - Minimum tillage (MT)
 - Zero tillage (ZT)



Profiles are collected with the aid of a scissor-jack

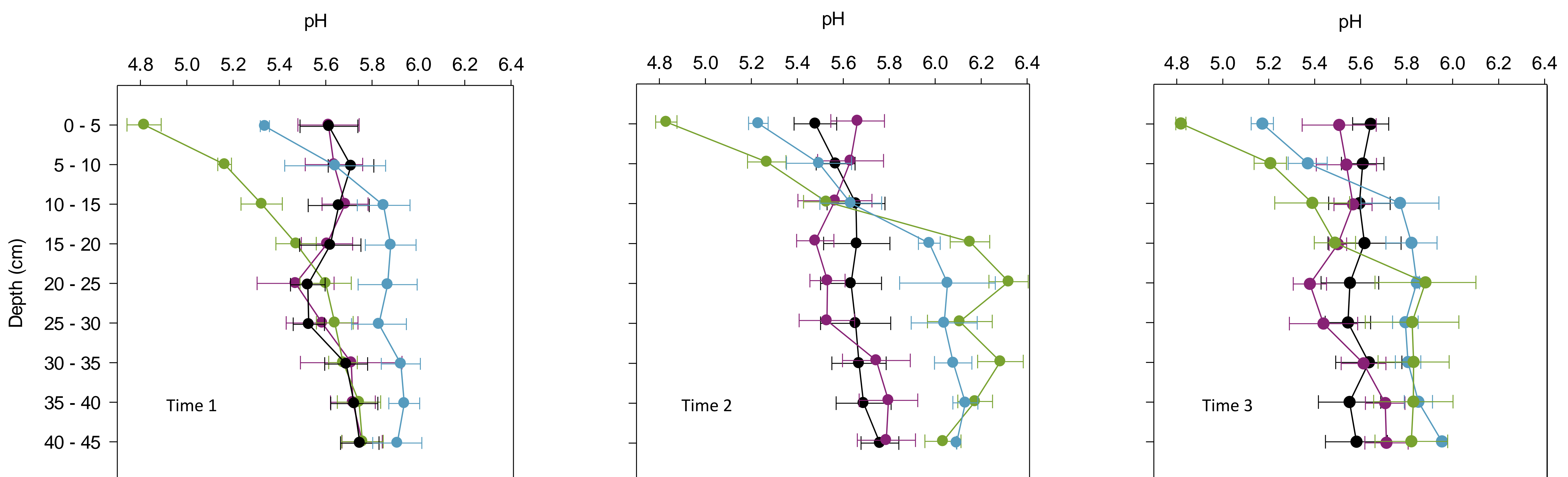


Soil profile with excess soil trimmed away

- Profiles dissected into spatially referenced samples
- Roots removed, scanned and frozen
- Analysis of soil physico-chemical parameters in relation to depth and distance across the drill line:
 - Bulk density
 - pH
 - Available & unavailable phosphorus
 - Nitrate, ammonia and dissolved organic carbon concentrations
- AM fungal community structure will be assessed using a combination of T-RFLP and selected sequencing.

Results

- No significant differences in pH across the drill line
- Increasing pH gradients with depth in MT and ZT: interaction between tillage and depth
- Little change in pH with depth in CP and DP treatments: role of tillage in mixing and homogenizing soil



pH with depth across different tillage treatments (means \pm S.E.; 3 replicates). Conventional plough: ● Deep plough: ● Minimum tillage: ● Zero tillage: ●

References

- FEMS Microbiol Ecol* **36**: 203-209
- Nature* **394**: 431
- Appl Environ Microbiol* **69**: 2816-2824
- Becker, K. (2011) MSc thesis, University of Aberdeen

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Future work

- Is succession of AM fungi along depth gradients in an arable system driven by plant growth stage or time of year? This will be tested by comparing results with a spring-sown cultivar
- Functional differences between the fungal communities from the different tillage treatments will be assessed in terms of P uptake and C transfer. Radioisotope tracers and intact mesocosms systems will be used for this