Fostering Populations Of Arbuscular Mycorrhizal Fungi Through Cover Crop Choices and Soil Management

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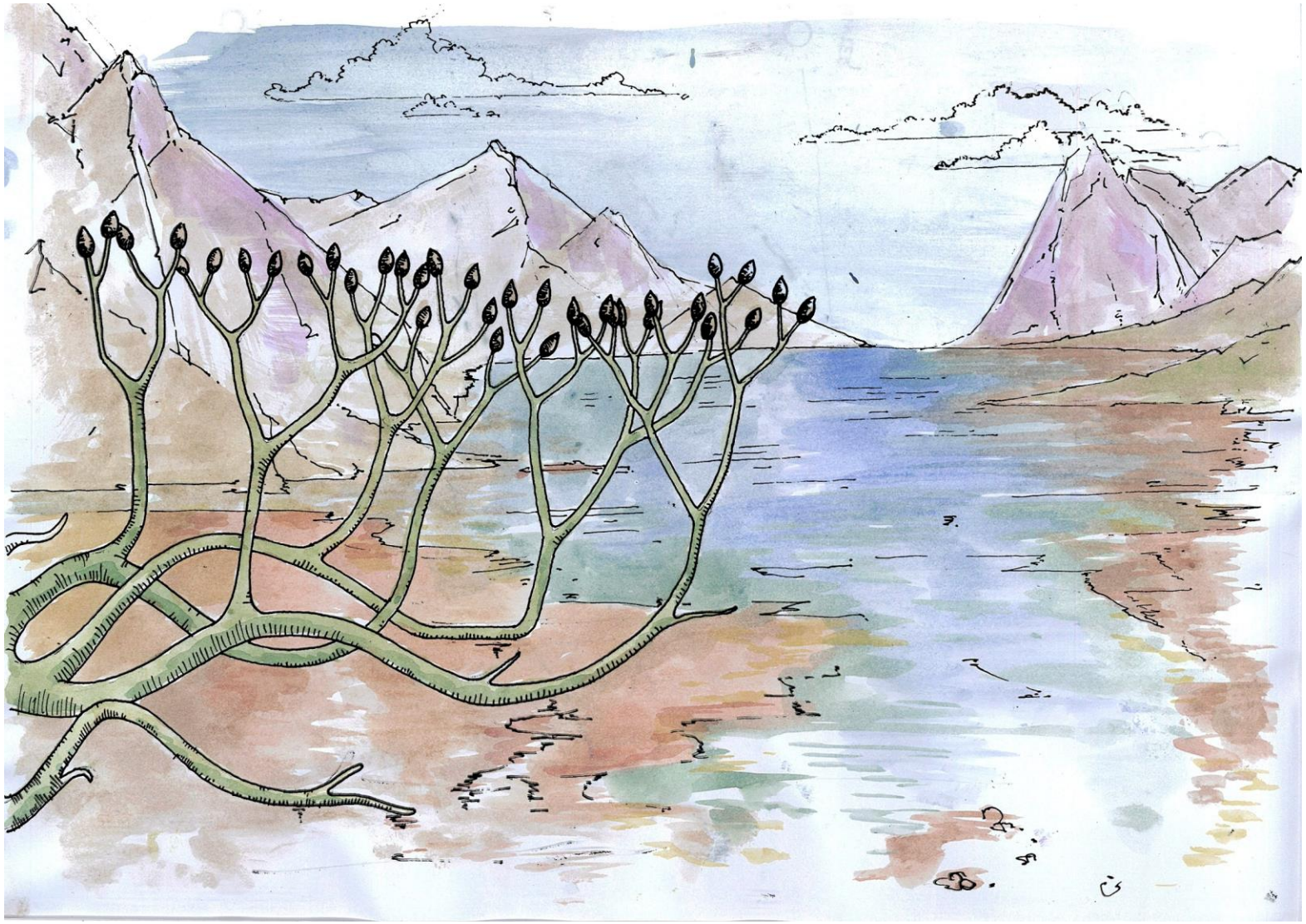
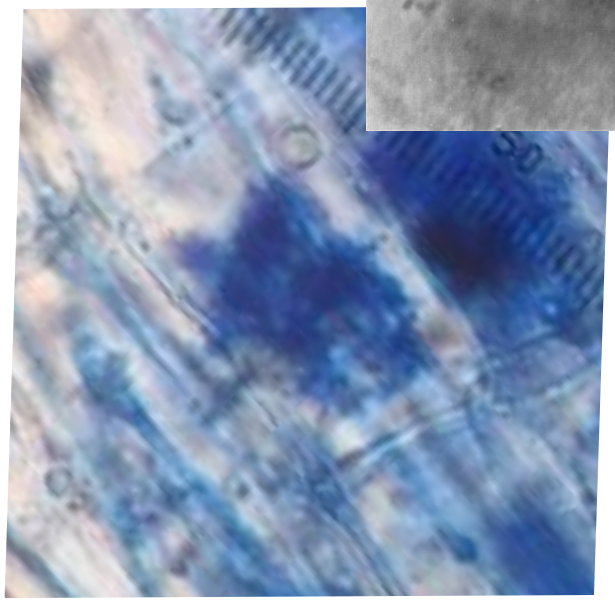
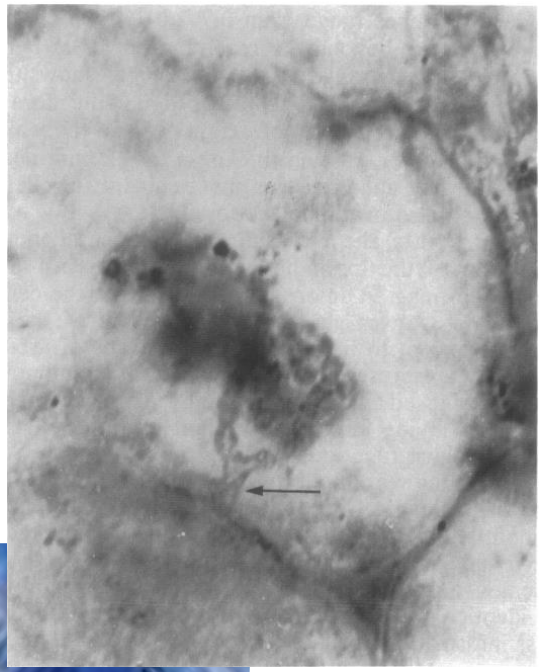
Ancient Arbuscular Mycorrhizal (AM) Fungi







(Remy et al. 1994)

AM Fungi 450 Million Years Later

- Interact with **80%** of extant land plants
- Essential for ecosystem functioning

- Studies show that colonisation by AMF resulted in:
  - 35% increase in **biomass**
  - 23% increase in **yield**

..But intensive agriculture **detrimental** to AM fungi

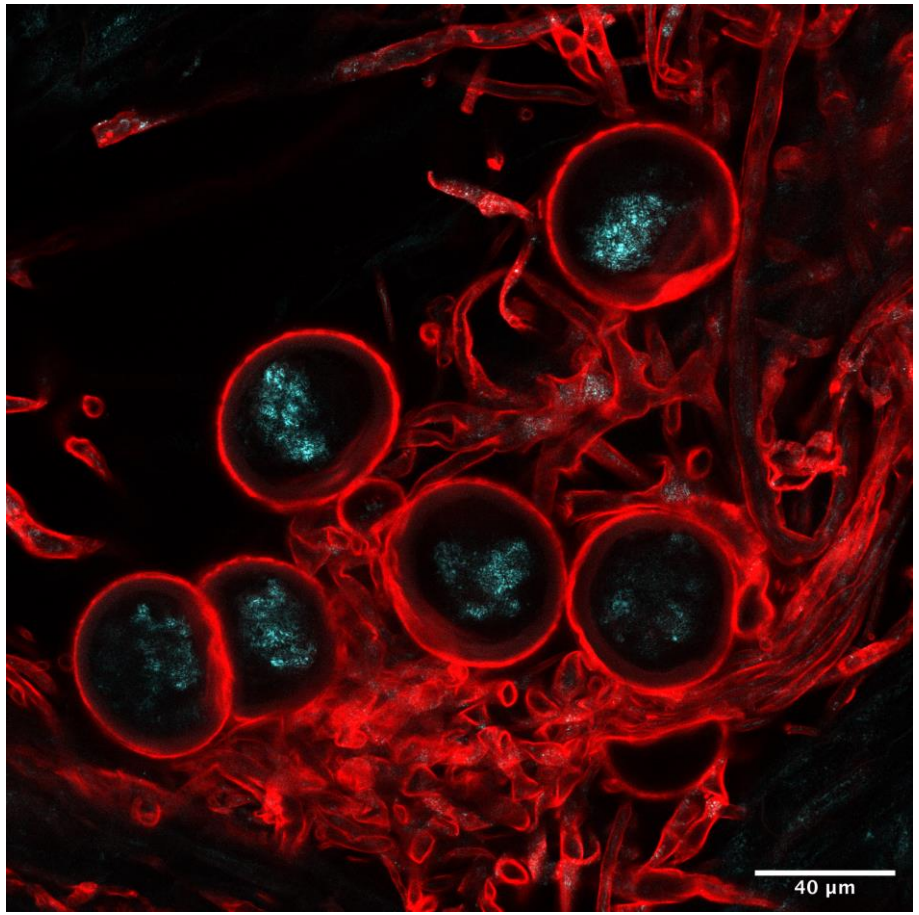
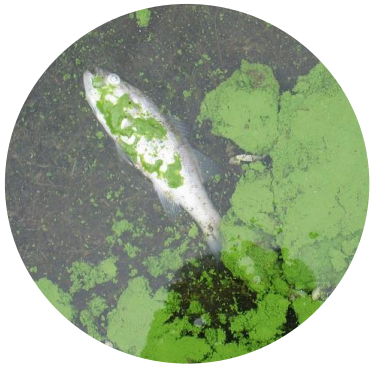
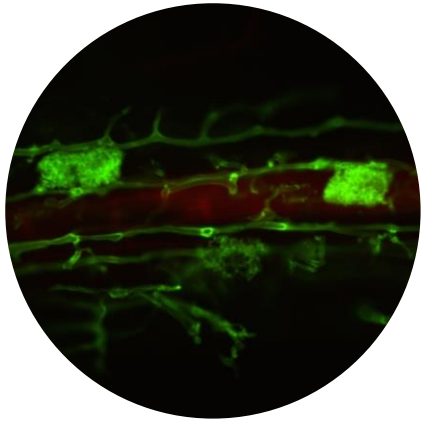


Image: Mieke Jürgens

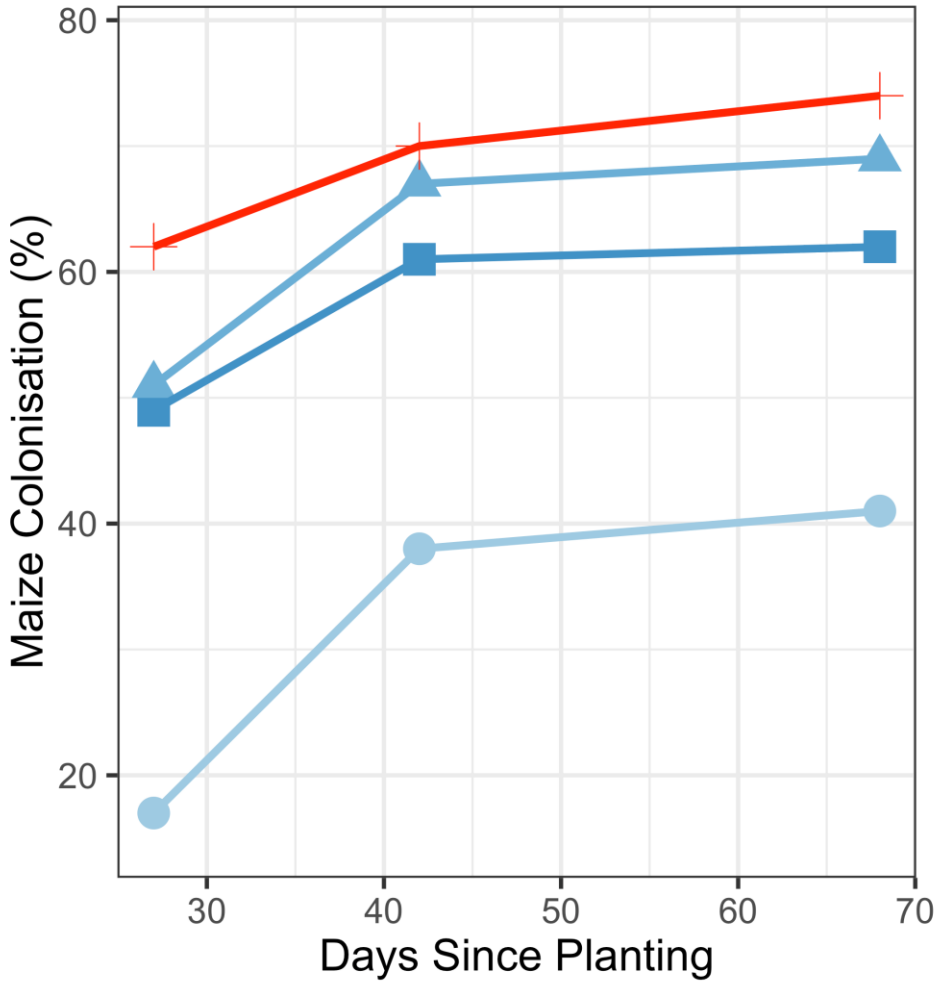
(Van Geel *et al.* 2016, Lekberg and Koide 2005)

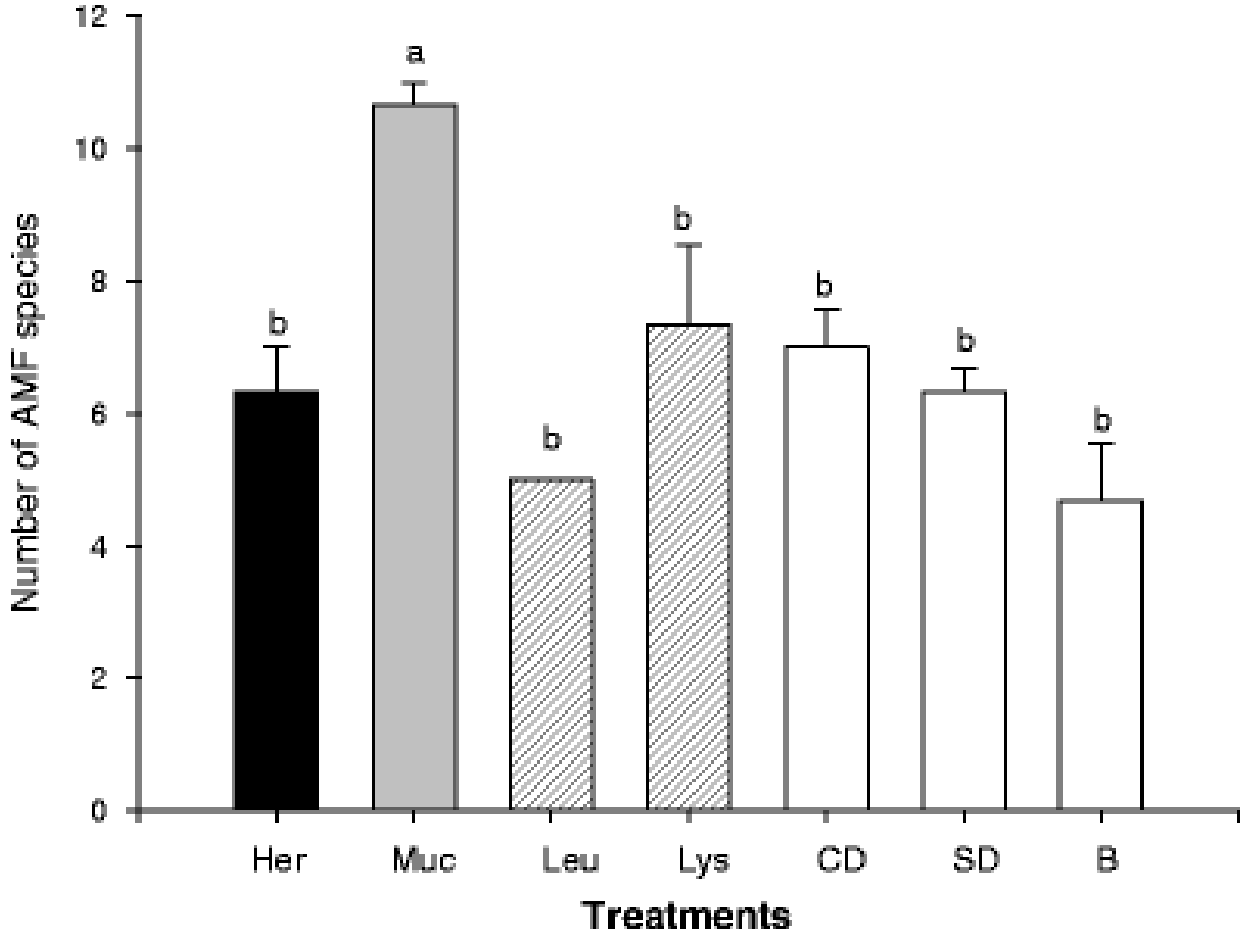
A Brief Introduction to Cover Crops





Cover Crops Can Improve Colonisation and Diversity of AM Fungi





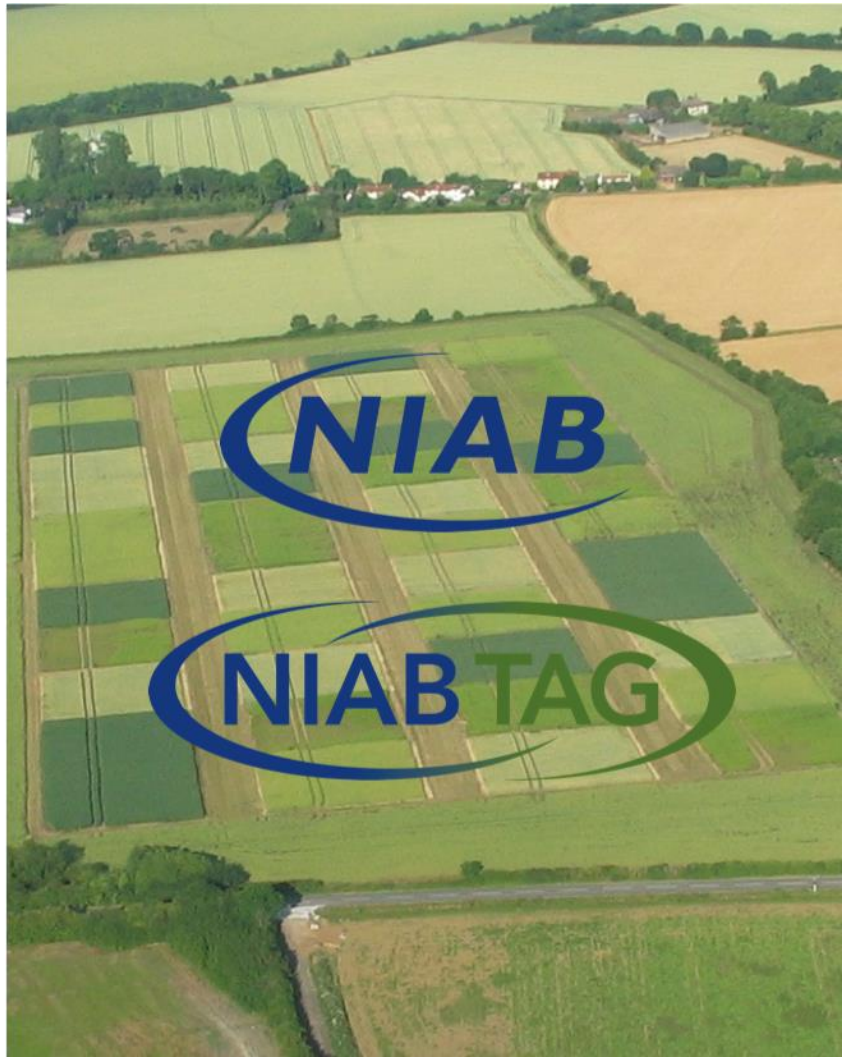
(Kabir and Koide 2002, Ramos-Zapata *et al.* 2012)

PhD Hypotheses

1. The use of cover crops promote the **establishment**, and **maintenance** of a **diverse** range of AMF species, which facilitates **increased interaction** with following cash crops

2. Increasing **diversity** and **abundance** of arbuscular mycorrhizal fungi improves **soil health**, crop growth, and yield of following cash crops

Current Projects

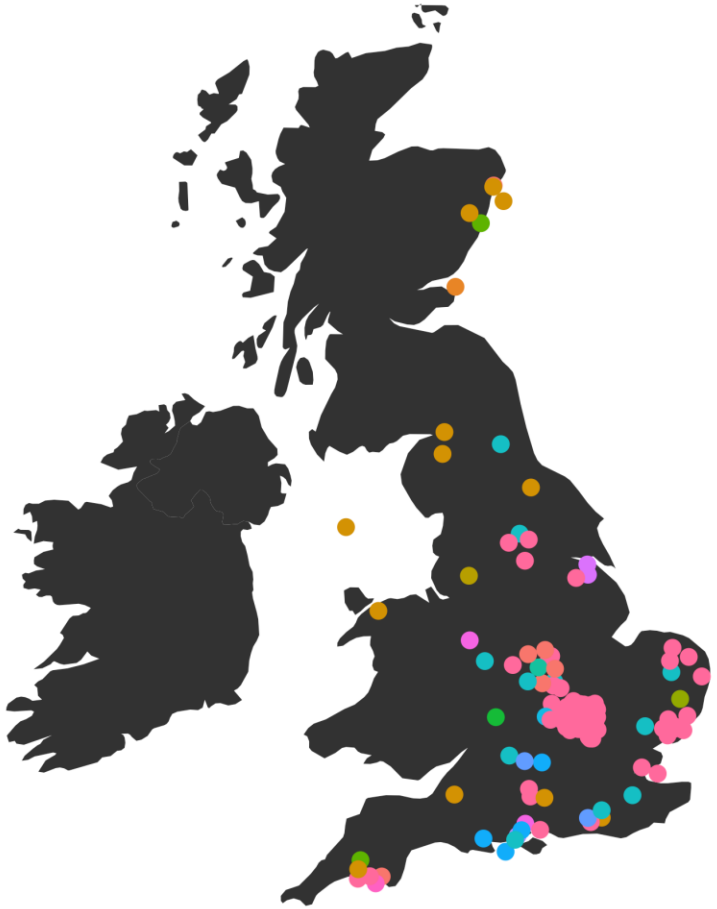


Current Projects – UK Wide Assessment of AM Fungal Diversity

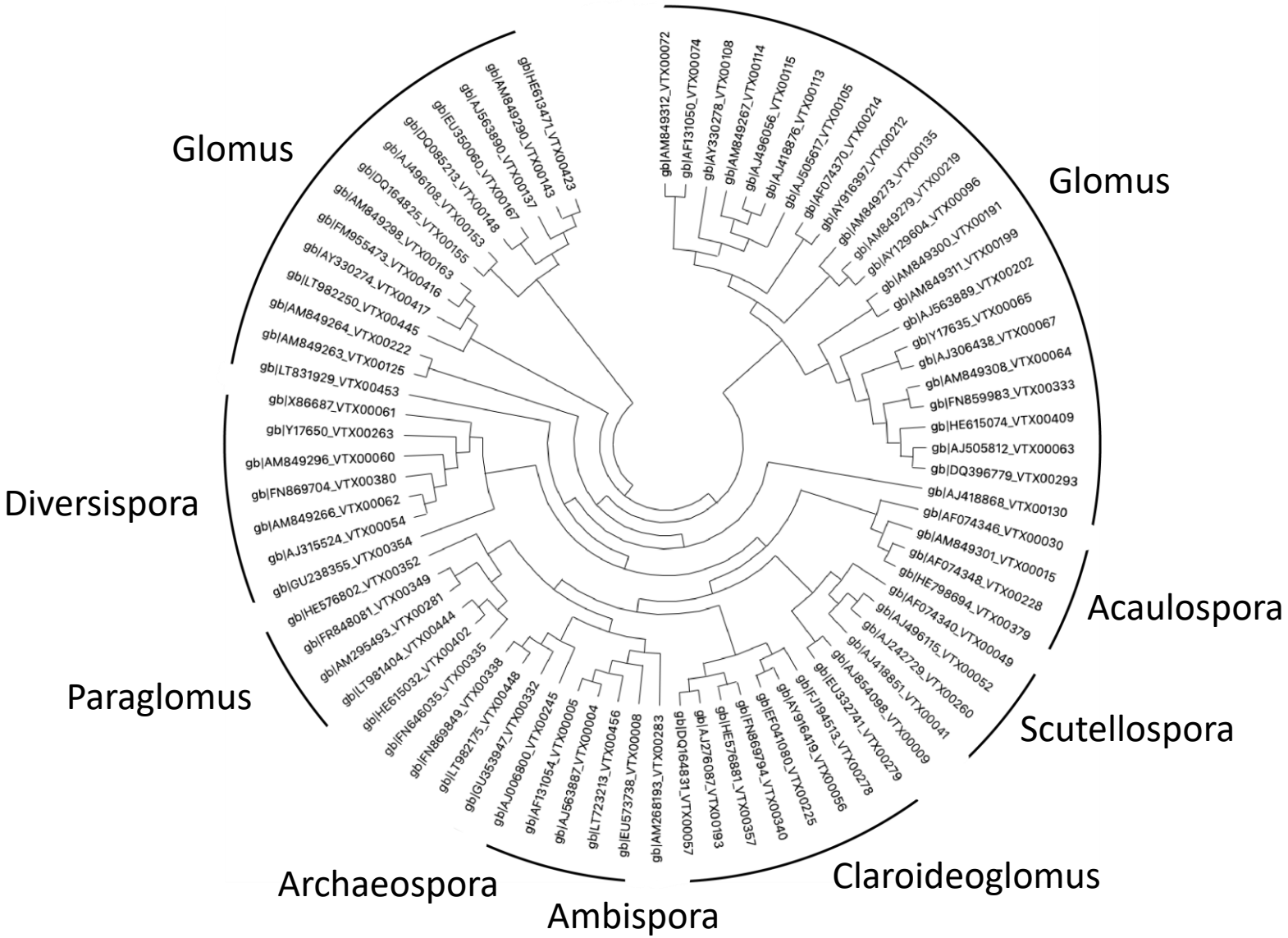
FERA Big Soil Community

- UK wide assessment of agricultural soil microbiome
- 258 soil samples submitted
- Sequenced for fungal ITS and bacterial 16S
- **No AM fungi detected**

- 150 of 258 sites selected
- 18S rDNA for AM fungi
- Nextera barcoded **NS31-AML2**



83 OTUs Identified

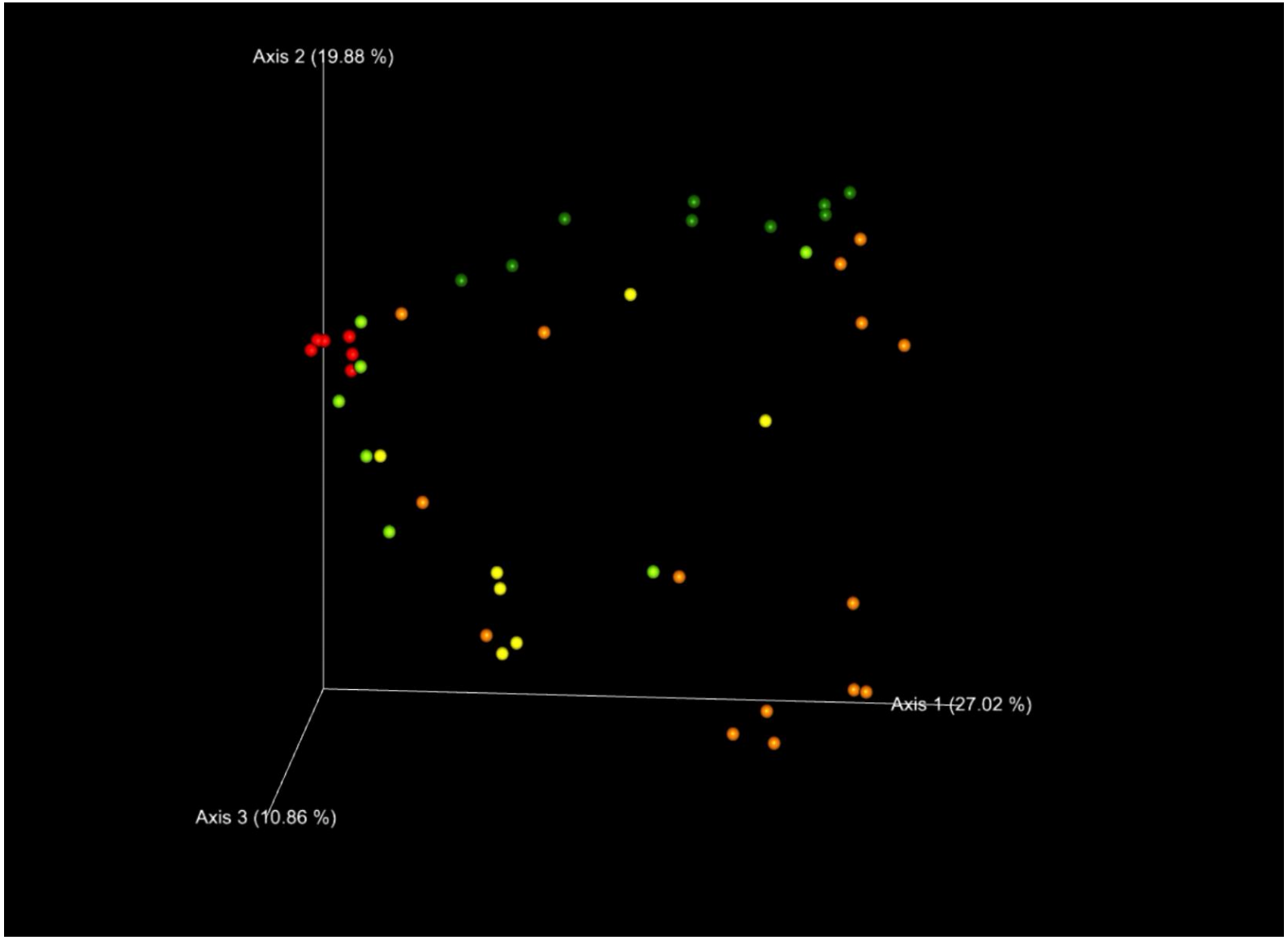


Most common OTUs

- VTX00281 *Paraglomus laccatum*
- VTX00283 *Ambispora fennica*
- VTX00448 *Glomus SS-G1*
- VTX00349 *Paraglomus sp*
- VTX00008 *Archaeospora s. arch1*
- VTX00065 *Glomus caledonium*

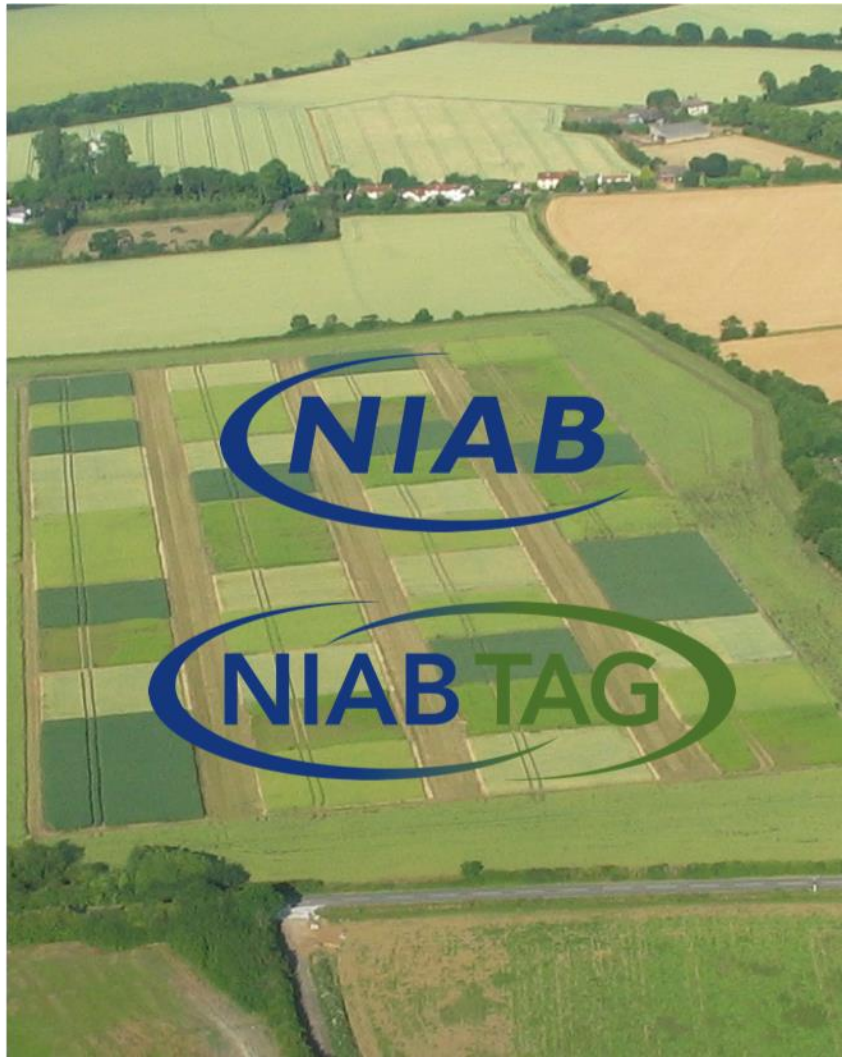
- 46% Glomus sp.

Cultivation (and Other Practices) Influence the AM Fungal Community

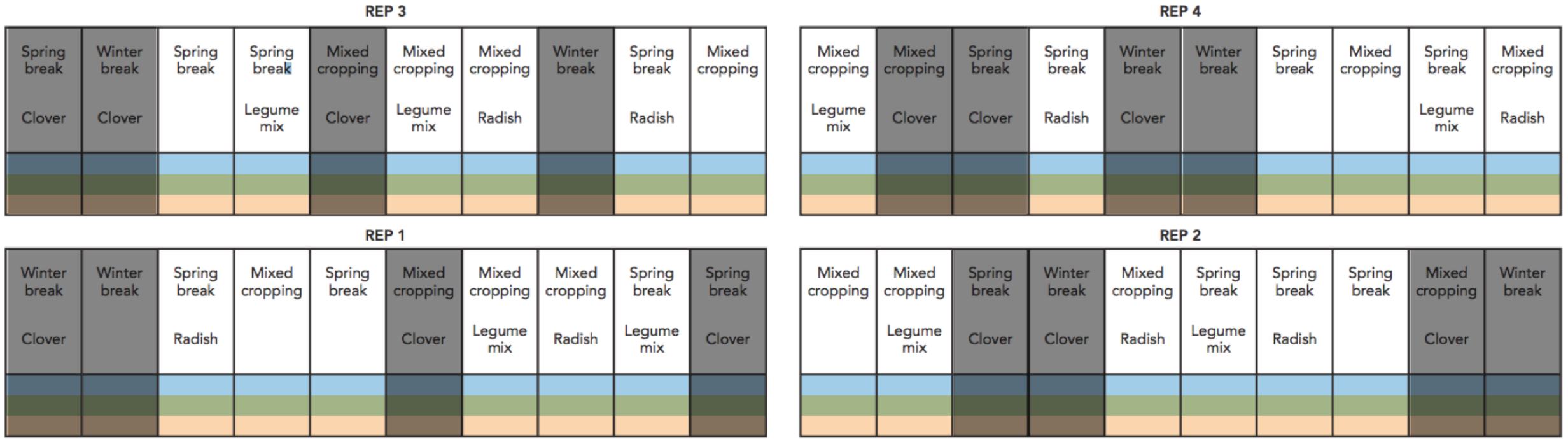


- No disturbance
- Minimal disturbance
- Mild disturbance
- Moderate disturbance
- Heavy disturbance

Current Projects – Replicated Field Trials



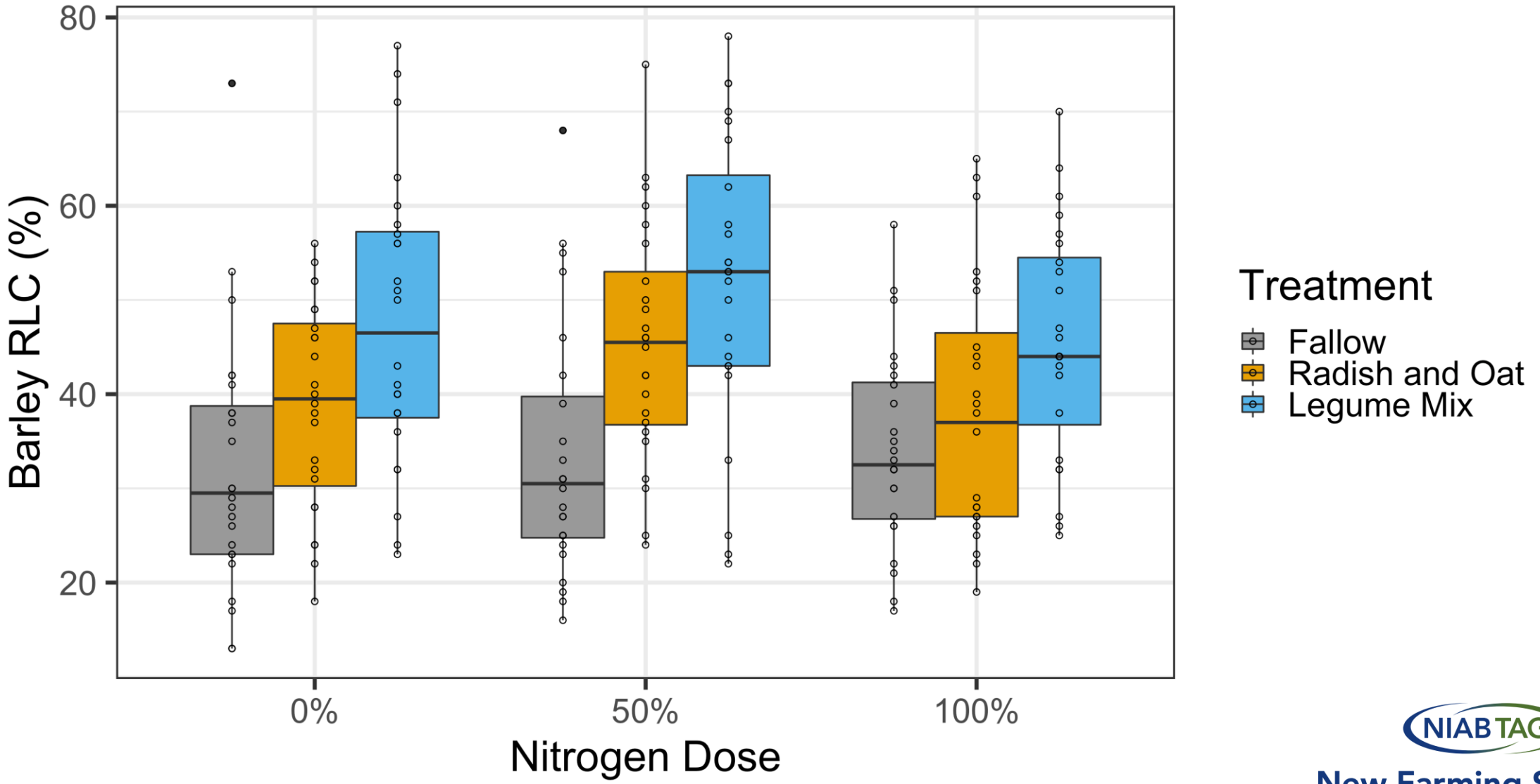
New Farming Systems (NFS) Fertility Building Rotations



- Legume mix, radish and black oat, fallow
- 0%, 50%, 100% nitrogen rate

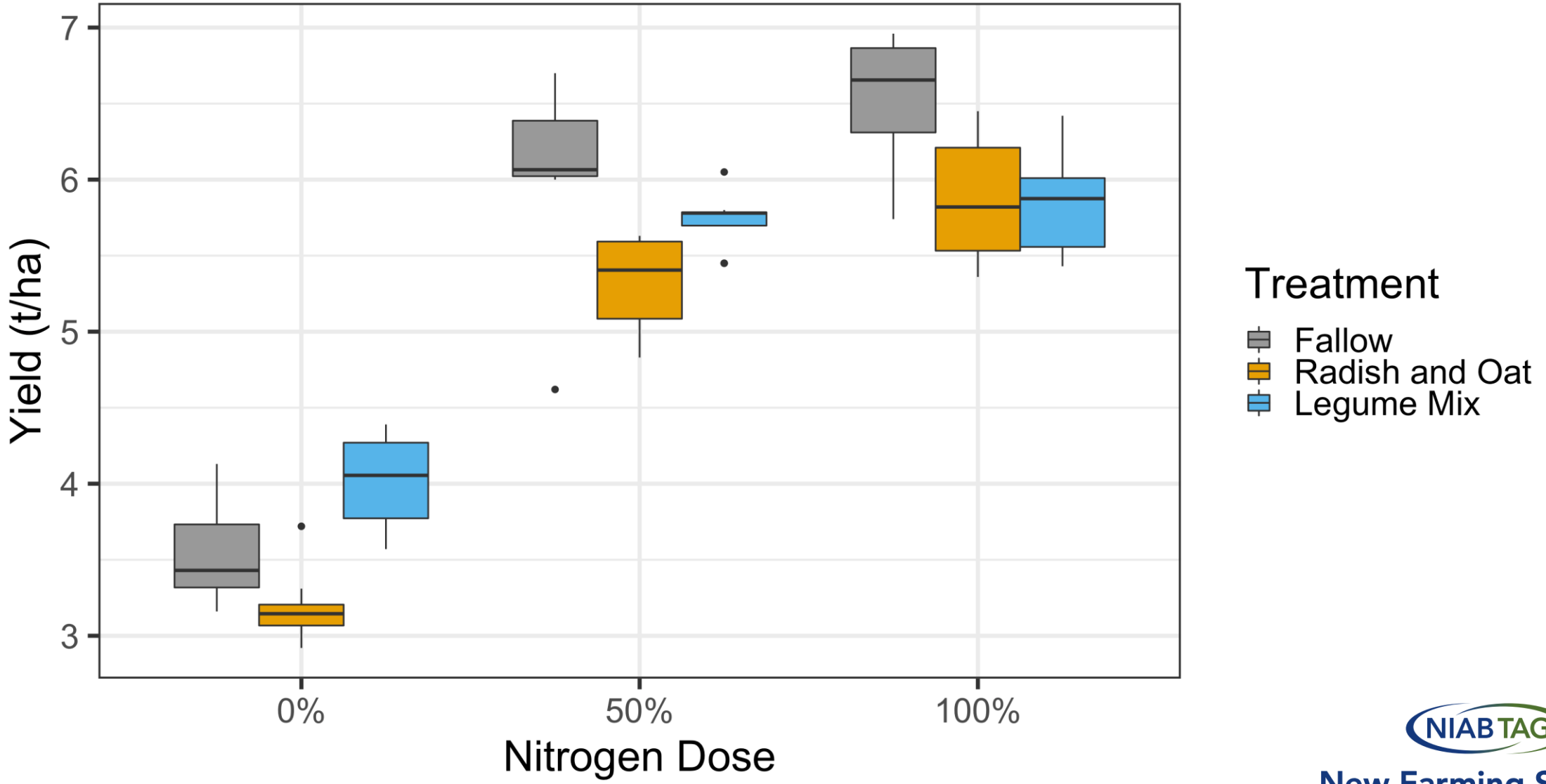
NIAB TAG
New Farming Systems

Cover Crops Increase Colonisation of Spring Barley



NIAB TAG
New Farming Systems

Cover Crops Impact Yield of Spring Barley



NIAB TAG
New Farming Systems

Current Projects – Farm Scale Trials

Innovative Farmers (IF) Experiment

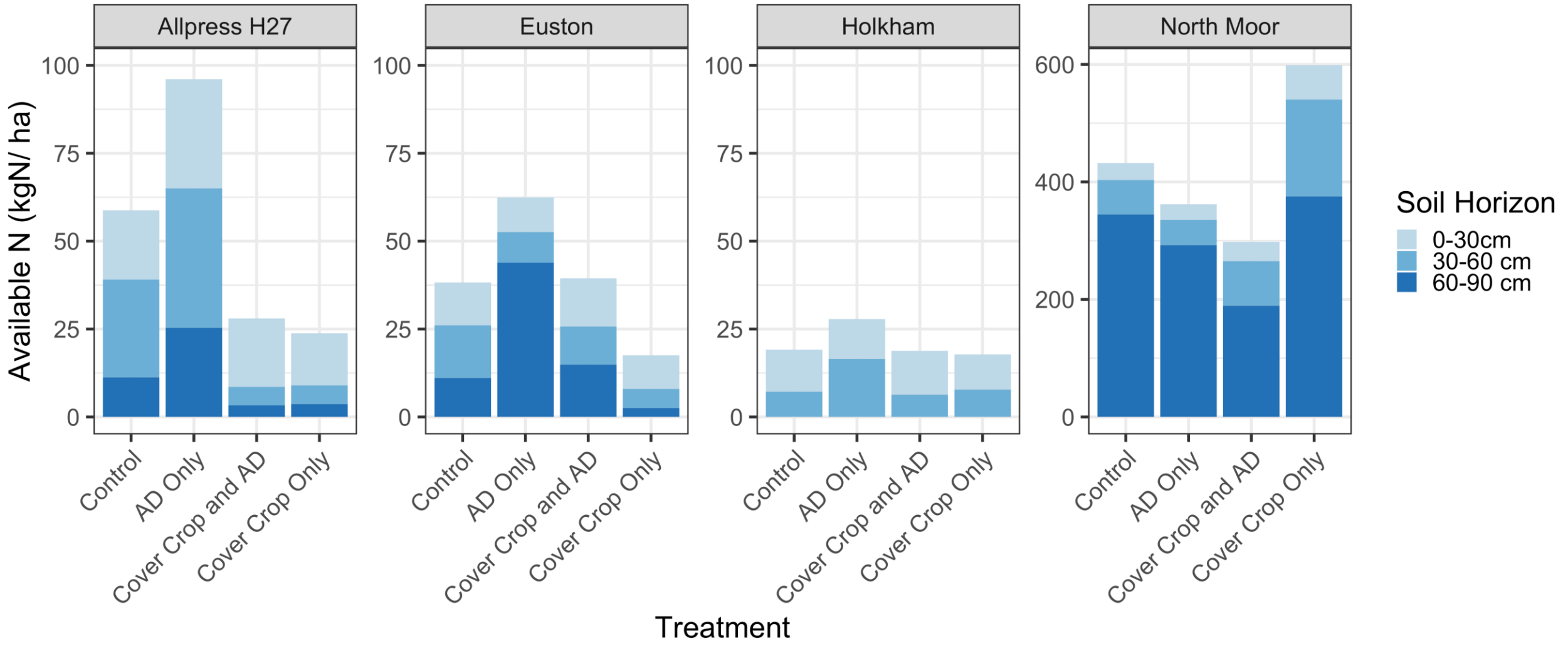
- Use of farm produced **anaerobic digestate** (AD) as a soil amendment
- Using **cover crops** to stabilise soil N, reduce **nitrification** and **leaching**
- Economic and environmental goals
- Subset of 4 of the original 7 IF sites

INNOVATIVE FARMERS
PART OF THE DUCHY FUTURE FARMING PROGRAMME

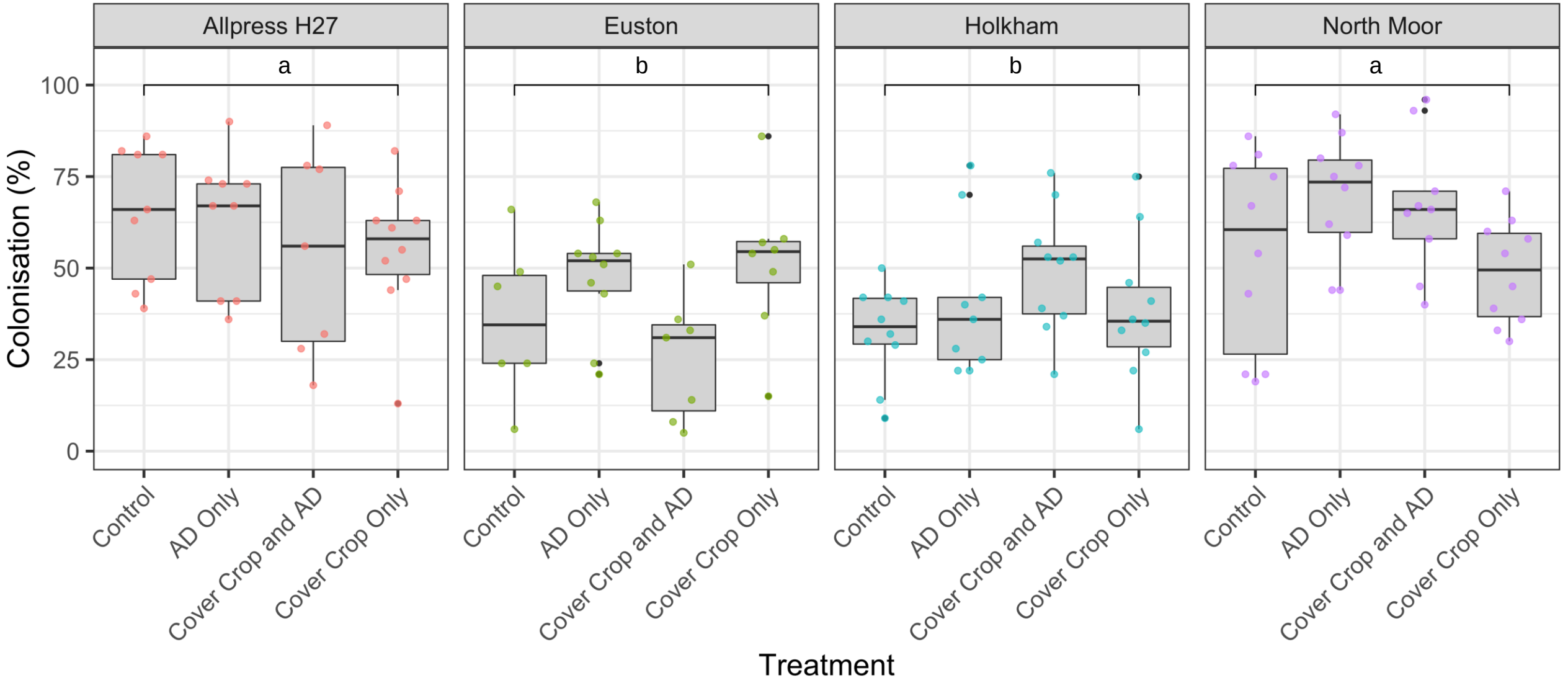
IF Experimental Design

- 2 hectare split field plots
- Radish, oat, vetch, (and buckwheat) cover crop
- Maize cash crop
- Farm practice and machinery

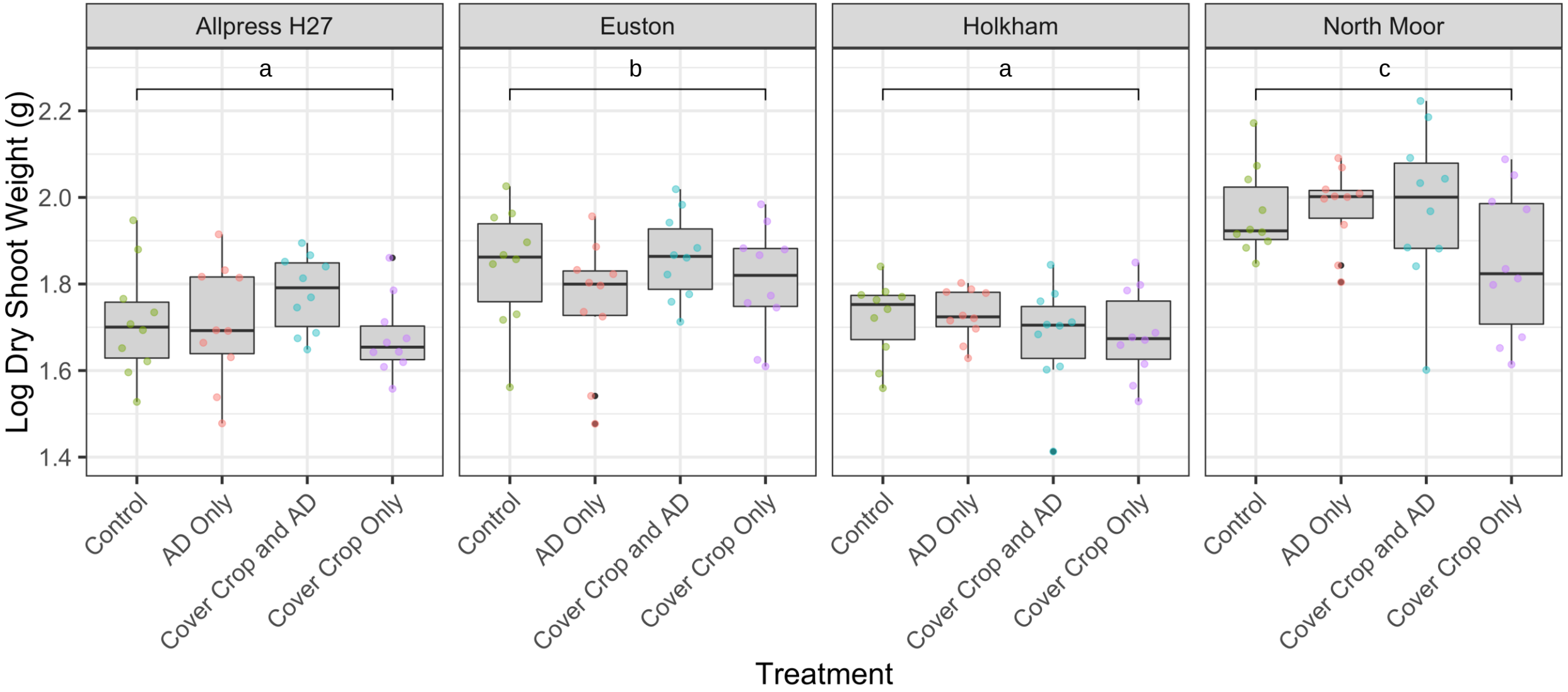
Cover Crops Reduce Leaching to Lower Soil Horizons



Cover Crops Do Not Impact AM Colonisation in the IF Project



Maize Biomass Is Not Influenced by Cover Crops or AD



Conclusions of IF project

..Farmers ploughed up their AM networks

Thanks!

- Dr Lydia Smith and the Innovation Farm team
- Professor Uta Paszkowski and the Cereal Symbiosis lab.
- Dr Nathan Morris, Dr Liz Stockdale, David Clarke, and the trials team at NIAB Morley
- Innovative Farmers: Jim and Patrick Allpress, Andrew Blenkiron, James Beamish, Phil Rayns, Robert England, and David Wright

AHDB

AFCP The AgriFood Charities Partnership

Agri-Tech East

Allpress

INNOVATIVE FARMERS PART OF THE DUCHY FUTURE FARMING PROGRAMME

Plant Works