Centre for Agri-Environmental Research, School of Agriculture, Policy and Development

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Soil faunal diversity and soil chemistry under diverse forage mixtures

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Background

Grasslands cover an estimated 7.2 million hectares in the UK, delivering animal-derived food stuffs and the guardianship of the countryside. It is becoming increasingly clear, however, that single-species improved pastures do not meet all requirements placed on modern agricultural production systems[1,2]. Encouraging a switch from intensively managed perennial ryegrass to a diverse forage system more supportive of soil health and sustainability is therefore required.

This project studies a selection of soil chemical, biological and physical properties to describe diverse swards' effect on soil functionality (Table 1). Research is conducted within an established diverse grassland experiment (Fig 1 & 2). Results will provide evidence to promote the use of diverse mixes; enhancing soil function and improving sustainability of the forage production industry.

Keywords: Diverse forages, ryegrass monocultures, climate change, ecosystem services, carbon sequestration, earthworms, mycorrhizal fungi, microbial function, perturbation, recovery, resistance, resilience

Research Topics

Table 1. Current research ideas with reasoning

Research Topic	Justification
Earthworm species/functional group abundance and biomass	Important ecosystem engineers. Important soil fauna for industry
Micro arthropods family/functional group abundance	Informative measure to represent food web dynamics
Mycorrhizal fungi root colonisation	Important symbiotic relationship for forage productivity by increasing plant phosphorus and water uptake
Root density	Extrapolate results of fungal colonisation. Important soil structure measurement. Important drought tolerance indication
Soil respiration used as a measure for resistance and resilience laboratory experiment	Response measure to push and pulse experimental flood and drought stress events, as predicted future weather events are forecast[1]
Soil and water chemistry (Carbon, Nitrogen and Phosphorus)	C – sequestration measurement for climate change alleviation N – measure of legume plant input for sustainable diverse forage performance P – important agricultural and environmental chemical

Hypothesis

Diverse mixtures support a greater diversity of soil fauna, are more resistant and resilient to stress, encourage higher fungal proliferation in the soil and sequester more soil carbon compared to ryegrass monocultures

Experimental site design

- 4.2 x 5m plots sown September 2016
- Perennial ryegrass-only control: applied with 250kg N/ha fertiliser spread across four applications yearly
- Three diverse forage mixtures sown with combinations of grasses, legumes and forbs: Smartgrass (6 species), Biomix (12 species), and Herbal (17 species)
- Design replicated over three soil moisture sites
  - 'dry' - typically experiences severe drought in summer
  - 'medium' - representing business as usual
  - 'wet' - suffers occasional flooding in autumn and winter
- Hand cut three times a year (May until September)

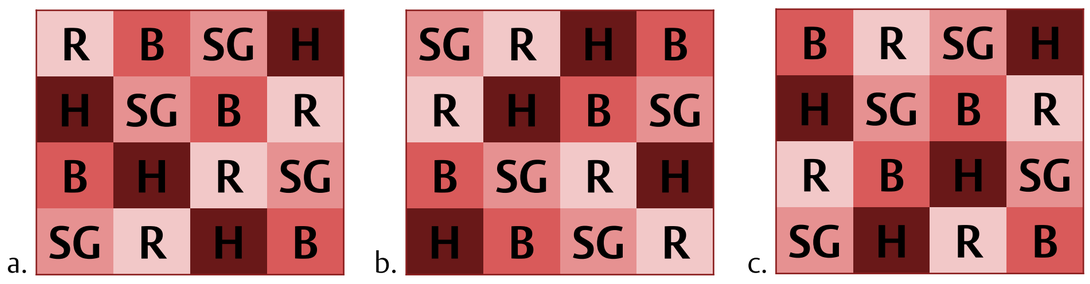

Fig 1. Schematic of Latin square design at three soil moisture sites: a. dry; b. medium; and c. wet. Forage species key: R – 1 species; SG – 6 species; B – 12 species; H – 17 species

Fig 2. Diverse forages experiment plots at the University of Reading Sonning farm

References

1. Hopkins, A. & Del Prado, A. (2007). Implications of climate change for grassland in Europe: impacts, adaptations and mitigation options: a review. *Grass and Forage Science*. **62**: 118 - 26
2. Luscher, A. *et al*. (2014). Potential of legume-based grassland-livestock systems in Europe: a review. *Grass and Forage Science*. **69**: 206 - 28

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