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

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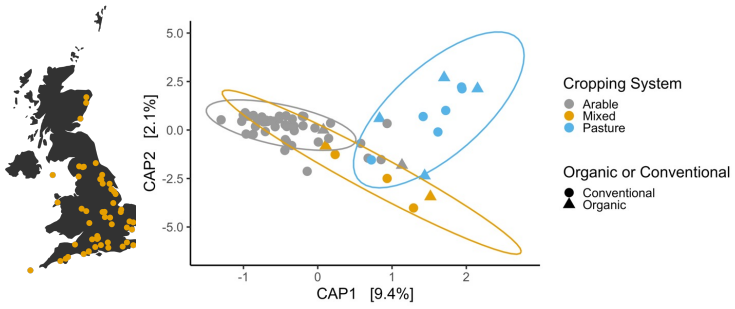
Motivation

Cover crops are grown for the purpose of 'protecting or improving' soil between periods of regular crop production. Amongst other soil health benefits, cover crops can enhance microbial communities, including arbuscular mycorrhizal (AM) fungi. AM fungi convey a range of benefits, including nutrient uptake, pest and pathogen resistance, and drought tolerance, in exchange for plant derived carbon. Wider research has shown positive impacts of cover crops on AM fungi, both in terms of diversity and abundance. In this project, the diversity of AM fungi in UK agriculture is described, before assessing the impact of various farming practices on AM fungal populations, and how these fungal populations can contribute to soil health, crop growth, and yield.

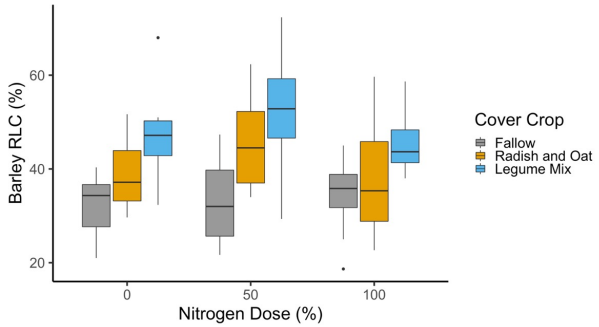
UK-Wide Analyses

In collaboration with FERA, 148 farm soil samples were sequenced for AM fungi, in order to better understand the diversity and abundance in UK agricultural soils. In total, 87 AM taxa were identified, including three previously unknown to science. Key factors underpinning AM fungal communities were whether a site was organic or conventional, the soil texture, type of cultivation, and whether fungicides had been applied.



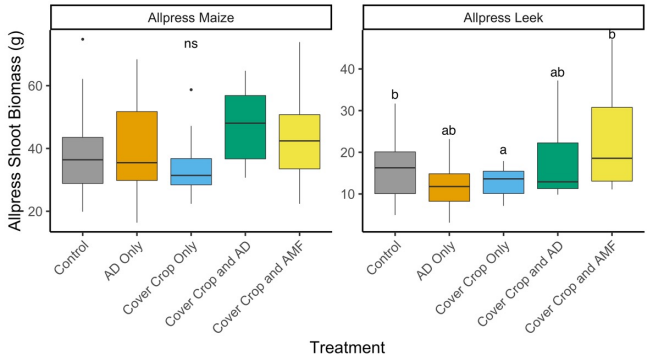
Replicated Trials

Next, the impact of different cover crop mixtures, AM fungal inoculation, and nitrogen application were investigated in replicated trials. Cover cropping was an effective method of improving the root length colonized (RLC) by AM fungi. Conversely, full rates of N fertilization were shown to negatively impact certain species of AM fungi, including those belonging to the genus *Glomus.* This suggests a role for these taxa in plant N transfer.



Field Scale

In two other trials, including an Innovative Farmers Field Lab, a commercial AM fungal inoculum had no impact on AM fungal populations, or crop yield in maize, barley, or oat. However, highly mycorrhizal leek had higher RLC and crop biomass following inoculation than some other treatments, but not the control. This suggests some level of species specificity for mycorrhizal induced crop benefit



Conclusions and Outlook

In this project, we show evidence that AM fungal abundance, but not diversity, can be influenced by cover cropping, and only after multiple iterations of cover crop growth. Leguminous cover crops are most beneficial, at least in terms of increasing cash crop RLC, however, cover crop mixtures including legumes may promote other soil health benefits. Further research on the genetics underpinning plant benefit from AM fungi may result in more effective inoculums, or improve crop varieties to maintain yields with lower nutrient additions. Such understanding would contribute to a more sustainable agriculture.

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