

The effect of moisture and plant communities on the mycorrhizal community structure in a low input agricultural system

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Introduction

Arbuscular mycorrhizal fungal (AMF) play an important role in agriculture by providing plants with essential nutrients and improving moisture relations (Gosling 2006)

AMF diversity and colonisation are greater in low input agricultural systems (Oehl 2003,2004)

The machair of the Outer Hebrides is a prime example of low input farming

Water content of machair soils varies considerably and was shown to be linked to soil community structure in the field

Little is known about the relationship between soil moisture content and AMF community structure

We designed an experiment to establish if, in the machair, soil moisture content and plant community composition is linked to mycorrhizal community structure

Method

Experimental set up

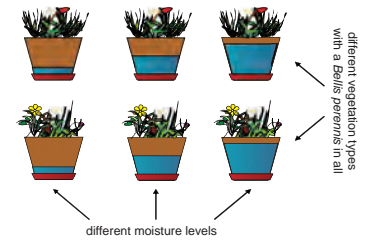
- A two-factorial experiment was set up with:
 - 2 vegetation types - plants typical for dry and wet machair grasslands
 - 3 moisture levels - low, medium and high

Harvest

For each pot:

- AMF community structure was analysed, using T-RFLP, from:
 - roots from *Bellis perennis* and
 - the remaining roots
- Aboveground biomass was determined and relative abundance calculated for each species

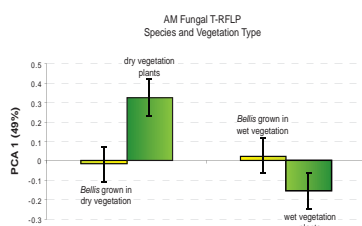
T-RFLP and plant biomass results were analysed using PCA and ANOVA



Results

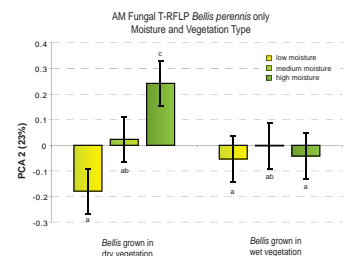
AMF and total vegetation

When the results for *Bellis perennis* and remaining vegetation are analysed together, PCA 1 shows a large variation in AMF community structure associated with dry and wet vegetation but there is no difference in communities associated with *Bellis perennis*



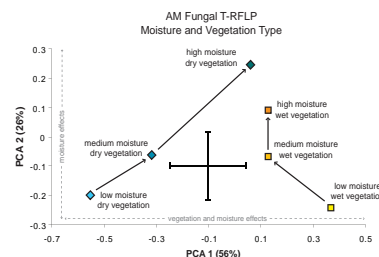
AMF and *Bellis perennis*

Analysis of *Bellis perennis* roots alone shows no effect of either moisture or vegetation type in PCA 1 but in PCA 2 there is an effect of high moisture on the AMF community composition when grown in vegetation typical of dry sites



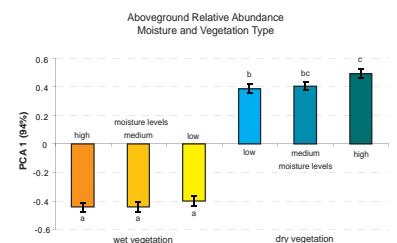
AMF and remaining vegetation

Within the remaining vegetation there is a strong interactive effect between vegetation type and moisture levels in PCA 1, with plants growing in low moisture soils having the most divergent communities. In PCA 2, moisture effects dominate with high moisture, dry vegetation samples being significantly different to low moisture, wet and dry vegetation



Plant community structure

The PCA of species relative abundances shows a strong separation between the two vegetation types and a small effect of moisture in the dry vegetation



Discussion/conclusions

Both vegetation type and soil moisture content are linked to AMF community structure, **but**

- it is dependent on which plant species is sampled; AMF communities associated with *Bellis perennis* are influenced very little by either soil moisture content or by the surrounding vegetation

- the level of moisture is important; at low soil moisture content the wet and dry plant communities have a very divergent mycorrhizal community structure whilst at high moisture levels the AMF communities are very similar to each other and to that of *Bellis perennis*

Both plant community and AMF community structure show a similar pattern, suggesting that the moisture effect on mycorrhiza in PCA 2 could be indirect, through changes in plant communities

References

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- Oehl, F., Sleverding, E., Ineichen, K., Mäder, P., Boller, T. & Wiemken, A. (2003). Impact of Land Use Intensity on the Species Diversity of Arbuscular Mycorrhizal Fungi in Agroecosystems of Central Europe. *Applied and Environmental Microbiology* 69, 2816-24
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Acknowledgements

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