Effects of soil health on ash dieback of *Fraxinus excelsior*

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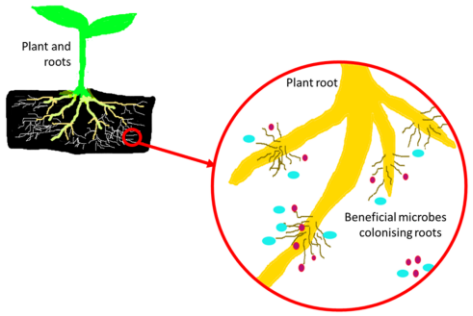
Introduction

European ash (*Fraxinus excelsior*) faces an uncertain future given high mortality rates from ash dieback disease. As few as 5% of ash have any natural tolerance of the disease and there are currently no effective management options. Ash tree susceptibility to ash dieback may be linked to the tree's microbiome, including aboveground endophytes which may pre-prime ash tree immune responses to ash dieback[1]. The belowground microbiome also plays a role in plant health[2], and is influenced by overall soil health. However, there has been little research into rhizosphere microbes' effects on ash dieback disease.

This project is assessing the effects of soil health on ash dieback, particularly the role of soil microbial biodiversity, and whether amending soils with organic materials influences ash tree susceptibility to ash dieback.

The role of soil health in tree health

Beneficial plant growth promoting rhizobacteria and fungi (PGPR/F) can colonise plant roots, potentially priming a plant's immune system, and triggering defence mechanisms that can help the plant better withstand pests and diseases. Research with agricultural crop plants suggests adding organic soil amendments such as biochar and compost can improve soil health, increase soil micro-biodiversity, and improve plant responses to pests and diseases[2], the same may be true for trees.



Field trial

In 2020 a field trial was established in Sussex growing ash seedlings with biochar mixed into the planting pits at 5,10 and 20% (v:v) and willow woodchip at 10%. The complete randomised block design has 4 replicates for each treatment within 4 blocks of 16 trees, with 20 isolation trees. Naturally regenerated seedlings were gathered in nearby woodland and planted through weed-proof membrane to avoid cultivating the very heavy clay soil.

Scan here for more information:

Pot trials

Three pot-based trials were established to test the effects of the following on soil health and ash dieback :

- **Biochar** - 1, 3, 5,10% v:v
- **Willow wood chip** - 10% v:v incorporated and as mulch
- **Peat-free compost** - 50% v:v
- **Peat-free compost (50%) and biochar** - 3, 5,10% v:v
- **Biochar primed with comfrey tea** - 3, 5, 10% v:v

References: 1.Harper *et al.* (2016) *Nature.* 2.Frenkel *et al.* (2017) *Journ. Environmental Engineering and Landscape Mgt.*

Challenges of tree field trials

Slow growth of trees – long duration between planting and availability of results, which also increases risk of damage/loss of trees from other factors such as rabbit herbivory (even with tree guards) and inclement weather.

High genotypic variance – need for high number of replicates to address likely genetic differences between individual trees when using naturally regenerated seedlings (former movement ban on ash, means older saplings are not readily available).

Long seed dormancy – ash seeds can take at least two years to germinate, so growing from seed is not feasible without a long lead time.