Harnessing Nature For Pest & Disease Control in UK Top Fruit

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Part 1

Pear Sucker (cacopsylla pyricola)
The Problem

Pear Sucker Adults

Pear Sucker Nymphs

Pear Sucker Eggs
The Damage
Traditionally control of pear sucker relied very heavily on broad spectrum insecticides such as pirimphos-methyl, amitraz or diflubenzuron to name but a few.

These were non-selective and as well as controlling the pest, also controlled the predators!

As a result, the more you sprayed, the more you needed to spray!

Well manicured orchards were believed to be best for keeping pear sucker populations low.

This is now widely accepted to NOT be the solution.

Long grass is now considered beneficial to provide shelter for pear sucker predators. Nettles are cultured to encourage anthocorids, the main predator.

Earwig shelters also installed in many orchards.
The Past

The Future?
Anthocorid Nymph

Anthocorid Adult
· It is possible to introduce Anthocorids artificially
· Rate = 5 bottles/ha at a cost of approximately £30/bottle
· Have to be applied by hand so high labour cost
· Best applied in evening when more likely to stay on site
· Habitat management critical to ensure sustained control
· Spirotetromat only chemical effective at pear sucker control
· Can only be used twice/season
· Warmer winters have led to pear sucker becoming a year round problem
Part 2

Apple Canker (neonectria ditissima)
The Problem
The Problem - Apple Canker

- **Infects** wounds (petal scars, leaf scars, pruning/picking) all year round
  - Conidia produced on young cankers - rain splash dispersed.
  - Ascospores produced on old cankers (3 months+) - wind dispersed !!
- **Killing trees** - up to 30% of newly planted orchards
- **Reducing yield**, quality and orchard longevity
  - Causing **postharvest fruit rot**
- **Commercial apple cultivars are highly susceptible.**
- Difficult chemical control:
  - Lack of effective chemical products
  - Timing / delivery issues (leaf scars, picking wounds, rain...)
  - Orchard hygiene labour intensive
- Apple canker impact compounded by climate change
Soil microbiome amendments for improved canker and climate change resilience?

In previous R&D projects:-

- **Arbuscular mycorrhizal fungi (AMF)** were found to:
  - Help with tree nutrition and water management
  - Increase drought (Wu et al., 2015) and waterlogging tolerance (Tuheteru & Wu, 2017).
  - Reduce the severity of Botryosphaeria canker on apple in India (Krishna et al., 2010).
  - Reduce severity of Neonectria canker in cider apple in the UK (Berdeni et al., 2018).

- **Trichoderma spp.** been shown to control canker diseases on almond (Holland et al., 2021)
A fungus which grows in association with the roots of a plant in a symbiotic relationship.

- Nutrient uptake primarily P, N, and Zn
- Protection from biotic stress: pathogens and herbivores
- Protection from abiotic stress: drought, heavy metal tolerance, salinity
- Soil stabilisation (glomalin), compaction
Trichoderma

- Fungi present in all soils which interact with the plant resulting in beneficial effects.
GKM: Resilient Apple Orchards project will investigate:

- The effect of AMF and Trichoderma as soil amendments against abiotic stress and apple canker
  - AMF (SR1, Plant Works)
  - *Trichoderma harzianum, Trichoderma atroviride*

- In newly established orchards:
  - 4 water logging prone sites, 2 drought prone sites
  - Gala/M9 (160-200 trees per site)
  - 6 treatments: control, AMF, Tricho. 1, Tricho.2, AMF+T1, AMF+T2
  - Tree growth, tree establishment canker incidence measured
  - First results in summer 2023
Canker Management – the future

GKM: Resilient Apple Orchards project will investigate:

- The delivery of AMF as a soil amendment in **mature orchards**:
  - During root pruning
  - With wild flowers
  - Tree growth, AMF colonisation of apple roots will be measured

<table>
<thead>
<tr>
<th>Common name</th>
<th>% in mix</th>
<th>Evidence for AMF association</th>
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<tbody>
<tr>
<td>Common Knapweed</td>
<td>14</td>
<td>Yes</td>
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<tr>
<td>Viper's Bugloss</td>
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<tr>
<td>Birdsfoot Trefoil</td>
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<td>Oxeye Daisy - (Moon Daisy)</td>
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<td>Selfheal</td>
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<td>Wild Carrot</td>
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<tr>
<td>Rough Hawkbit</td>
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<td>Wild Red Clover</td>
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<tr>
<td>Musk mallow</td>
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<tr>
<td>Devil's-bit Scabious</td>
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</table>
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