# Wool for crop resilience

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**Domain Flagship Textiles. Topic 5: recycling of discarded carbon-based materials.**

## Objectives

Which wool treatment is needed to keep plant performance? Does wool increase plant performance and reduce disease?
What microorganisms are dominating in the wool-based media? Bring together partners to further develop the use of wool in horticulture

## Wool tests on chemical properties and plant performance

### *Wool fatty acid and nitrogen composition*

We quantified the fatty acid and nitrogen content in wool. GC-MS analysis of the unwashed wool shows a broad signal and specific sharp signals that correspond to cholesterol and derivatives, present in wool grease. Washing the wool reduces the intensity of the broad signal, but cholesterol remains (**Figure 1**). The amount of nitrogen in the soil samples was comparable for the samples with 0% and 10% wool (v/v), whereas the sample with 25% wool had a much higher N-content.

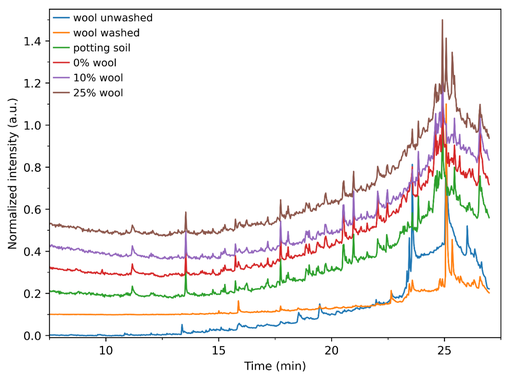


**Figure 1.** Normalized GC spectra for all samples measured at approximately 5 mg/mL.

### *Wool as growing media*

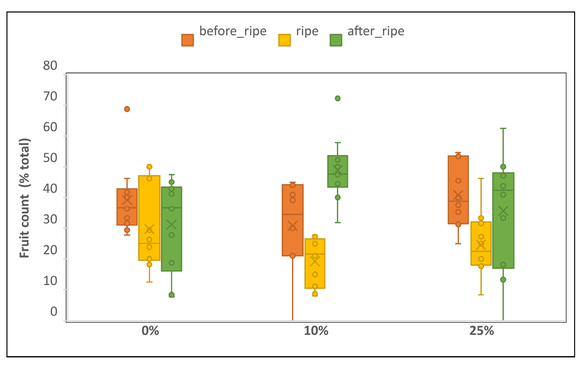


**Figure 2.** Greenhouse experiment with strawberry plants. We counted strawberry yield before, during and after ripening phase. Fruit count is given in proportion to the total.

We performed an experiment with strawberry plants in the greenhouse using washed wool mixed with coconut fibres and soil as growing media. Results showed that 10% v/v washed wool in the growing media allowed plants to grow, having a higher absolute plant weight, yield and less tip burn. Furthermore, strawberries ripened faster in 10% wool (**Figure 2**). 25% v/v wool substrate affected negatively to the plants.

### *Wool and disease suppression*

We run a bioassay with garden cress and the pathogen *Pythium,* with washed and unwashed wool at two concentrations. Seven days after sowing (DAS) plants growing in wool (no pathogen) showed better photosynthesis efficiency (**Figure 3A**). Infected plants did not show differences in disease spread, all of them were sick. However, four DAS we could notice that seedlings with 0.1% w/w mixed into the soil delayed the disease spread (**Figure 3B**).

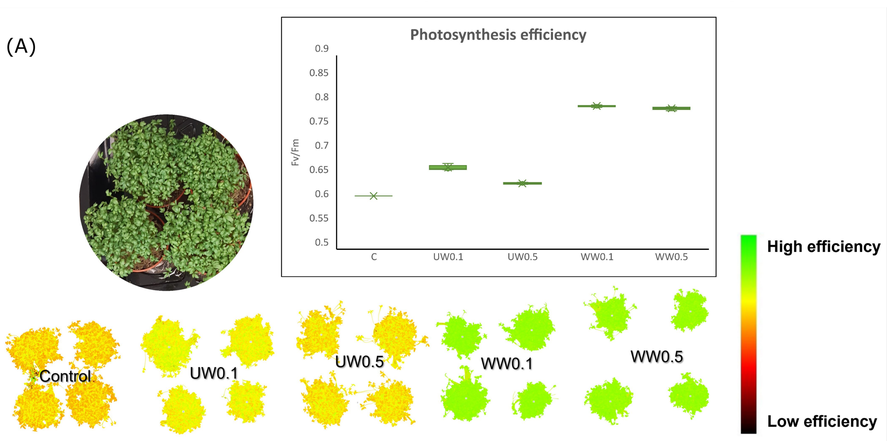


**Figure 3.** Pathogen bioassay with *Pythium*. A) Photosynthesis efficiency in plants without pathogen. B) Signs of disease in seedlings 5 DAS. WW: washed wool; UW: unwashed wool; 0.5: 0.5% wool w/w; 0.1: 0.1% wool w/w.

(B)


## Lessons learned

### *Wool shows potential to be further applied in agriculture and horticulture*

✓ washing the wool removed most of the fatty acids, and 25% w/w wool soil samples still contained detectable wool grease.
✓ wool contained high N from protein, especially the washed wool.
✓ Washed wool at 10% v/v helped fruits to ripe faster
✓ Washed wool improves photosynthesis efficiency in plants, and at 0.1% w/w seems to delay the disease spread.

## Readiness

The project TRL is at around 6, where we are testing the capacity within a controlled environment that reflects the spatial-temporal context (greenhouse). However, some remain questions are unanswered. For example, we need to:

- dive into what microorganisms are associated to the wool, for safety and as biostimulants source (analysis ongoing)
- we need to test what type of wool treatment e.g. wash is the most appropriate to enhance plant productivity and/or reduce disease
- How is soil composition affecting these effects?

## Next steps

What steps do we need to further develop wool research for a circular agriculture?

1. Finalize gathering all the data needed
2. Designing new experiments to test the effect of different treatments or wool composition
3. Discuss with stakeholders about our findings and new ideas

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BAPS number: KB 45-005-011