THE IMPACT OF COVER CROPS ON MICROBIAL ACTIVITY AND COMMUNITY COMPOSITION IN STOCKPILED SOILS

Michele Kiernan[1] , KJ. Stanton[2,3], J. Jones[3], C. Sharp[3], R. Thompson[3], T. Pettitt[3], M. Nason[3] and E. Duley[3] ✉

[1]Derriford Research Facility, University of Plymouth, PL6 8BU, [2]Soil Association, Spear House, 51 Victoria Street, Bristol, BS1 6AD,
[3]Eden Project Learning, Eden Project, Bodelva, Cornwall, PL24 2SG

BACKGROUND

- **The construction and development industry displaces large quantities of soils and aggregates, much of which is sent for disposal.** The construction industry generates approximately 60 million tonnes of soils and approximately 80 million tonnes of aggregates in the UK [1]. This equates to approximately 60% of the total tonnage received by UK landfills.

- **Microbes as indicators of soil health.** Soil microbes are involved in many aspects of soil function: regulating nutrient availability, aggregate stability, carbon sequestration, remediation, pathogen resistance and promotion of plant growth. However, there is no 'ideal' soil microbial community which applies to all soils [2].

- **Maintenance of soil health in a construction context** could focus on minimising soil carbon losses, maintaining soil microbial activity and ensuring stockpiled soils are maintained to a point where they can be reused effectively in the future.

PROBLEMS AND OBJECTIVES

- **Soil stockpiling will impact soil quality, structure and biodiversity** [3], often leading to soil degradation. Little is known about soil stockpiling impact on soil microbial communities and how to mitigate against soil degradation.

- **In this study** we aimed to monitor microbial activity in stockpiled soils as a soil health indicator and, with the addition of cover crops, investigate methods to mitigate against soil degradation in stockpiled soils

WHAT WE DID

- Soil was arranged into 12 windrow shaped stockpiles sized approx. 6 x 4 x 2m

- Piles were randomly sown with one of 3 treatments; amenity grass mix, herbal ley seed mix or no seed (control), half of each stockpile was covered with a thin layer of mulched wood chip

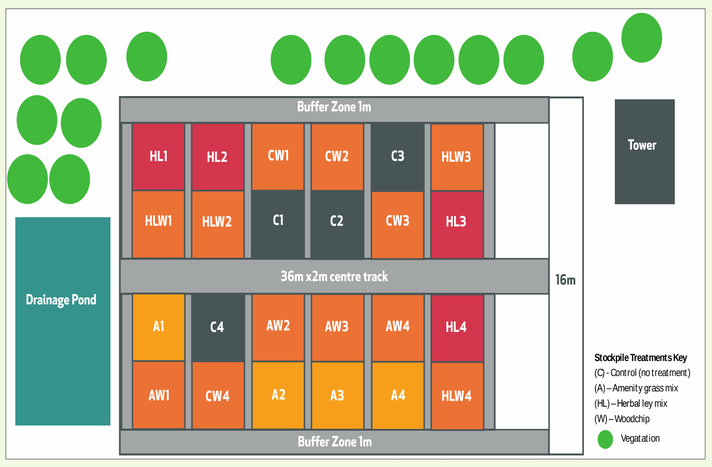

Figure 1. A diagram of the study site and experimental design of the soil stockpiles

- Soil samples were taken from each replicate (n=24) at depths of 0-30 cm and 90-100 cm, at T0, 1, 2 and 4 weeks and then at 4 weekly intervals

- Microbial activity in the soil was assessed by measuring CO_2 flux in-field with the TARGAS-1 infrared gas analyzer, the microBIOMETER® in-field kit and in the lab by fluorescein diacetate assay (FDA) and by 16S and ITS sequencing of soil eDNA

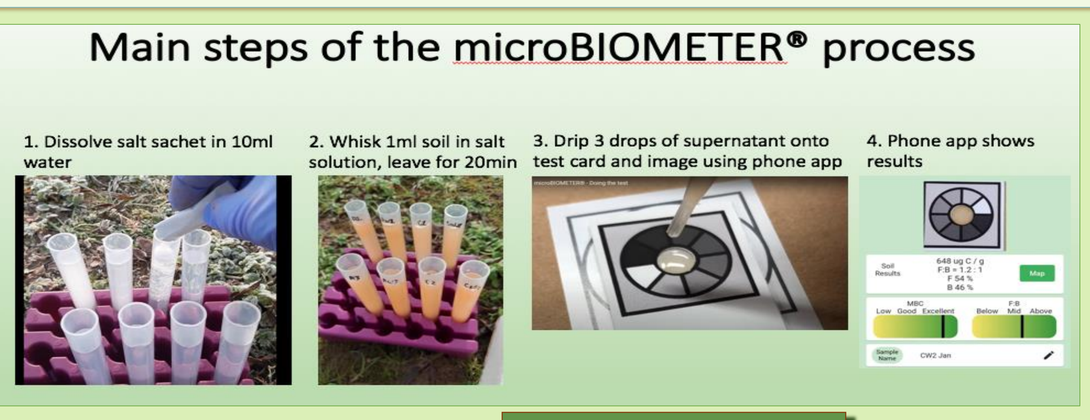

Figure 2. Creating soil stockpiles at Bicton College, August 2022

WHAT WE FOUND

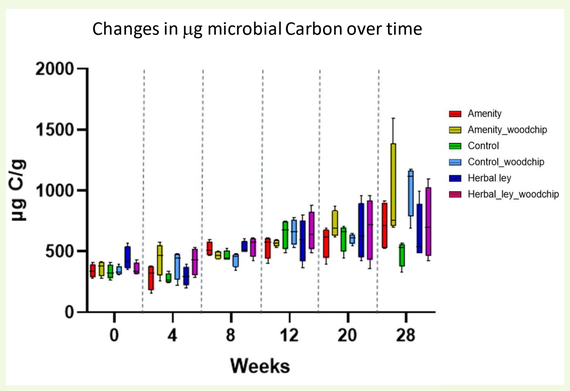

Figure 3. MicroBIOMETER® readings of µg of microbial Carbon in the soil over 28 weeks (n=4)

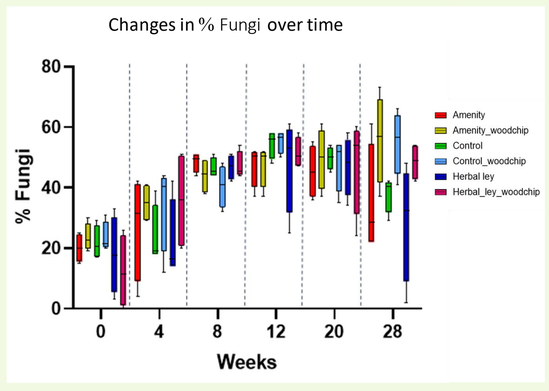

Figure. 4. MicroBIOMETER® readings of percentage of fungi in the soil microbiome over 28 weeks (n=4)

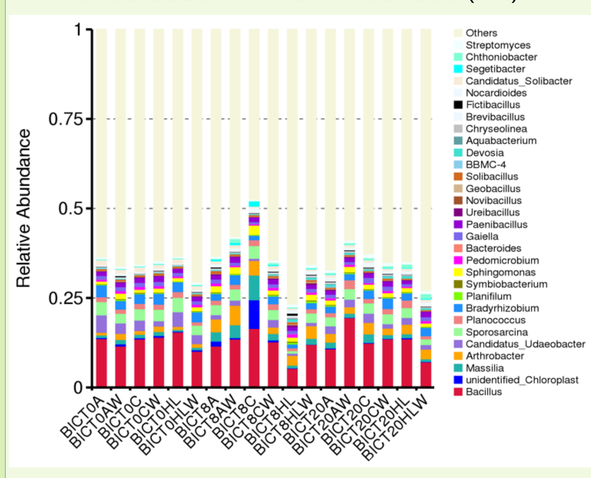

Figure 5. 16S analysis of the bacterial genera in the Bicton stockpiles at Time 0, week 8 and week 20

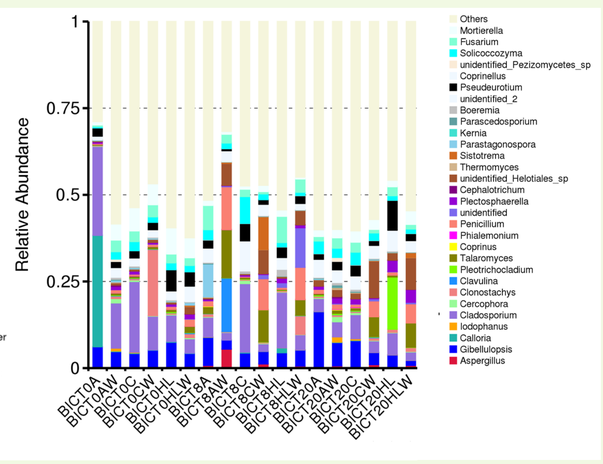

Figure 6. ITS analysis of the fungal genera in the Bicton stockpiles at Time 0, week 8 and week 20

- After one month, the microBIOMETER® readings showed that the amount of microbial carbon in the stockpiles decreased, however overlaying the stockpiles with woodchip seemed to prevent this (Figure 3) and the percentage of fungi after 4 weeks was also higher under the woodchip (Figure 4). Over the subsequent months (October to January) there were apparently no treatment differences, until the 7th month (March, week 28) when there were higher levels of microbial carbon and fungi under the woodchip. There appeared to be no significant differences between the cover crop treatments and the control stockpiles, although a dense root network was observed under the woodchip on the herbal ley seeded stockpiles.
- The in-laboratory FDA showed a lot of variability, although a trend towards lower activity readings in the control piles was observed (data not shown)
- CO_2 flux showed no treatment differences and lower readings in colder months (data not shown)
- Soil eDNA analysis by Illumina sequencing showed no significant differences in the bacterial population between the different treatments at genus level (Figure 5). At phylum level, however, a trend towards an increase in *Actinobacteria* over time was observed (data not shown). Fungal eDNA analysis showed that a number of fungal genera in the soil under the woodchip increased over time, such as:, *Talaromyces*, *Clonostachys* and *Helotiales* (Figure 6).

CONCLUSIONS

- Microbial activity appears to remain stable across all treatments, however, results suggest a trend towards woodchip covering for maintenance of soil carbon and encouraging fungal colonization in soil stockpiles.
- Surprisingly we found little difference between the different cover crops in the short timeframe of this experiment. Perhaps due to carrying it out over winter.
- The microBIOMETER® kit is a relatively economical and simple method which can be used to give a rapid in-field measurement of soil microbial communities, although it's unclear how this relates to eDNA and other lab tests, therefore further validation of the kit is required.

* SCAN FOR MORE

* Includes references

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CONTACT

@PlymEarth @EdenDegrees

emma.duley@cornwall.ac.uk

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