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Effect of Compost Added with Compostable Plastic Packaging on Wheat Health and its Rhizosphere Microbiome

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INTRODUCTION

- Packaging waste is steadily increasing in Europe.
- **Compostable plastics** (CPs) may represent an **environmentally friendly alternative to petroleum-based plastics** for the development of innovative **packaging solutions**.
- The **potential impact** of **CPs** presence **in compost** on **soil ecosystems** and **crop health still needs to be assessed**.

AIM OF THE STUDY

To evaluate and **compare the effects produced** by **"standard" compost (C)** obtained from urban organic waste (UOW) and UOW **compost obtained by adding 3% compostable bioplastics to organic waste** (**CV**), on **wheat health** and its **rhizosphere microbiome**.

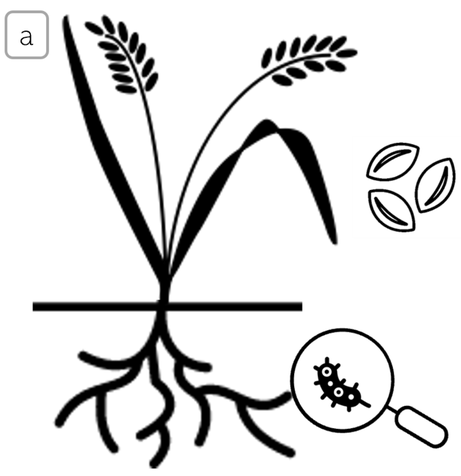
METHOD

Field experiments were conducted at Agricultural Research Station, CERMIS, Italy. During 2021-2022, **three treatments** (**C**, **CV**, and **B** - no compost) with **five replicates each**, were tested (**Fig. 1b**, **c**).

Soil chemical-physical properties were measured before and after composts distribution to evaluate changes in nutrient concentrations and presence of possible pollutants.

At the flowering stage, **10 plants and associated rhizospheric soils** were collected in each plot (**Fig. 1a**).

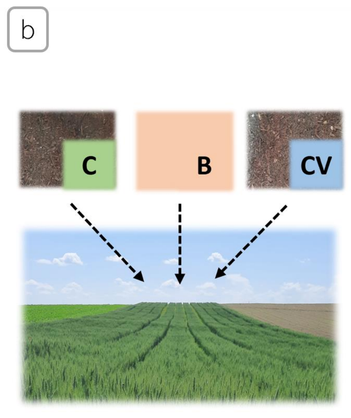
a



Morphological and productive wheat traits were measured and analyzed

Rhizosphere bacterial communities were analysed by 16S rRNA metabarcoding

b



c

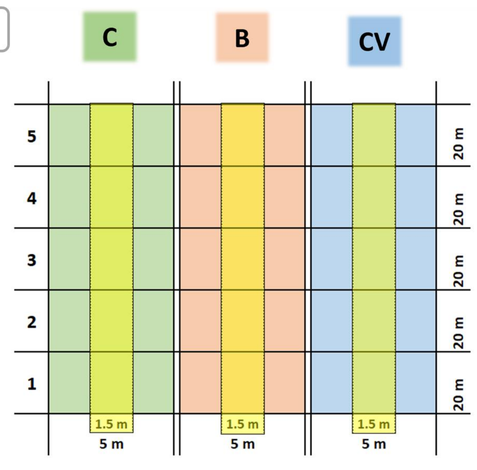


Fig. 1 a) Wheat parameters considered in the study; *Triticum aestivum* L SOLEHIO variety has been used. **b**) Photo of the experimental field (CERMIS, Italy) and **c**) drawing of the experimental design applied in the study. In green: standard compost (C); in pink: control (B, no compost); in light blue: compost obtained by adding compostable bioplastics to organic waste (CV). For each of the treatments, 1000 kg of compost have been distributed along 500 m^2. Soil sampling and harvesting activities have been performed in the center of each plot, within the yellow area. The composts were distributed in 0-25 cm layer of soil, one month before wheat sowing.

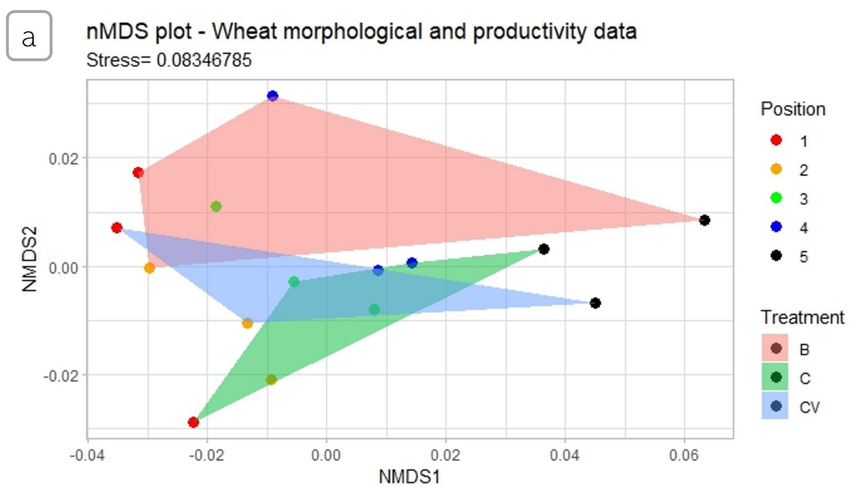
RESULTS

No significant differences between treatments were detected by means of **wheat traits** (**Fig. 2a**).

C and CV **compost fertilization** significantly **changed the bacterial communities** with respect to the untreated control (**Fig. 2b**).

No significant differences were found between the C and CV communities, which also showed similar composition. Results showed a substantial **equivalence of the two composts**.

a



b

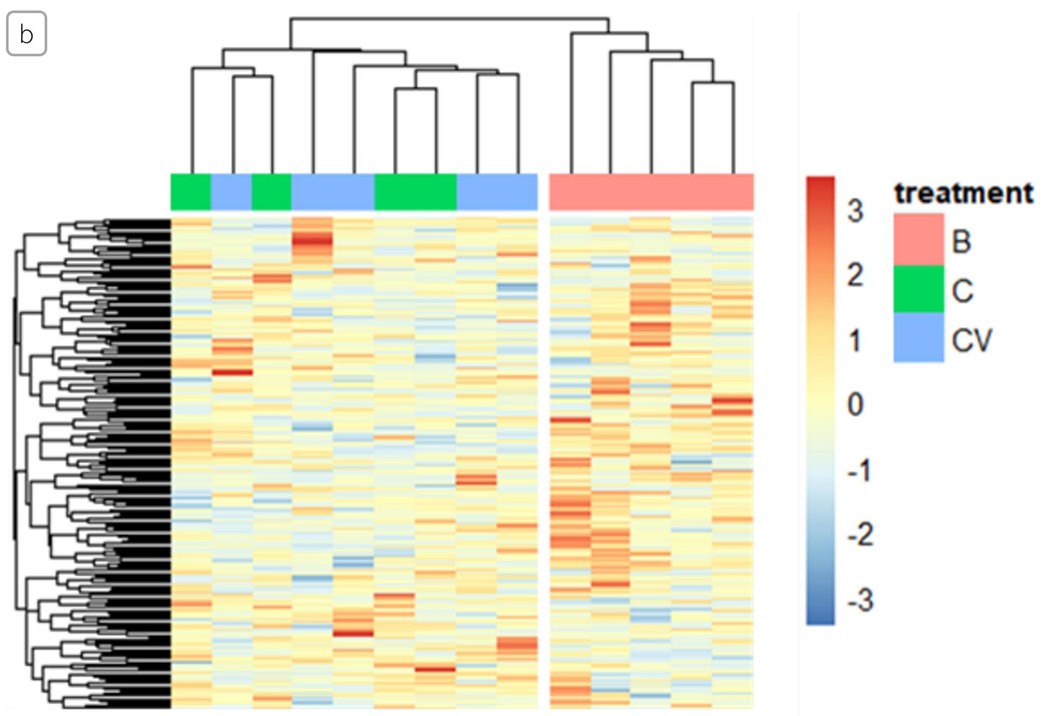


Fig. 2 a) Bray-Curtis based non-metric multi dimensional scaling (nMDS) plot representing wheat morphological and productive traits for control (B), treatments (C: compost and CV: compost obtained by adding compostable bioplastics to organic waste) and positions (sub-plots 1-5). The permutational multivariate analysis of variance (PERMANOVA) was used to test for differences between groups. P-values < 0.05 were considered significant. **b**) Dendrogram and heatmap of wheat rhizosphere bacterial communities. The plot highlights different bacterial abundances in control (B) and treated plots (C, CV). Plots were made with R 4.2.0 program, "vegan" and "ggplot2" packages. Qiime2 has been used for molecular data analysis.

CONCLUSIONS

Preliminary results showed that **CPs** addition **do not negatively affect compost quality** neither **wheat** nor **microbiome health**.

CPs may represent a **sustainable alternative** to conventional plastic that will be crucial in the **green European transition**.

Furthermore, fungal rhizosphere communities will be analyzed by ITS rRNA gene using metabarcoding approaches. Interactions between the two taxa will be investigated through network analysis.

ACKNOWLEDGMENTS

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