Theme 1
Status and trends of global soil nutrient budget

ABRIOPACK Project: Preliminary Data on the Effect of the Use of Compost Added with Compostable Plastics on Crop Health and Possible Interactions with the Rhizosphere Communities

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INTRODUCTION

Within the field of circular economy and sustainability, the recycling of domestic bio-waste is a very relevant topic today. The use of compost as soil amendment is increasingly encouraged as a way to bring back nutrients and enrich crop systems. The application of compost provides benefits such as improvement of soil structure, increase fertility, and soil organic matter content. However, new materials including compostable plastics are increasingly used today and consequently present in the organic fraction of municipal waste (OFMW), from which the compost could be obtained. Until now, few studies have evaluated the effect of these materials, supposed to be environmentally harmless on crops and their rhizospheric microbiome. Therefore, to keep using this resource is advisable to test the quality of compost obtained from compostable bioplastics (Markus and Ramani, 2021). The main aims of the study is to evaluate and compare the impact of the use of "standard" OFMW compost and compost added with 3% of compostable bioplastics packaging (OFMW-BP) provided from Novamont S.p.A. Novara, Italy (Alessandroni *et al.,* 2022), on wheat health and the associated rhizospheric microbiome by mean of DNA metabarcoding approaches.

METHODS

Field experiments were conducted at Research and Experimentation Centre for Plant Improvement (CERMIS) and the composts have been used to fertilize wheat (*Triticum aestivum* L. – SOLEHIO variety). The experimental design included three treatments with 5 replicates each (OFMW compost, OFMW-BP and control (no compost addition) (Fig.1).

Sampling has been performed in May 2022; in each subplot 10 wheat plants at the flowering stage and the related rhizospheric soil were collected. Physico-chemical analyses of the soil were done before compost distribution and will be repeated after the harvesting to test the level of nutrients as well as the presence of possible pollutants. The morphological characteristics of the plants (height, ear size, chlorophyll content, wet and dry weight etc.) have been evaluated. Data were checked for normality (Shapiro-Wilk test) and homoscedasticity (Bartlett test) before analyses. The subplots were compared for treatment (inter-plot) and, within the same treatment, and according to their position along the experimental-field slope (intra-plot) (ONE-WAY ANOVA). Differences within groups were evaluated through TukeyHSD test. The statistical analyses were performed using R 4.2.0 software.

RESULTS

Based on the analyzed parameters there are no significant differences between the applied treatments. However, significant differences in plants' height were observed within the subplots of the same treatment (Tab.1), while no differences were found when considering subplots belonging to different treatments.

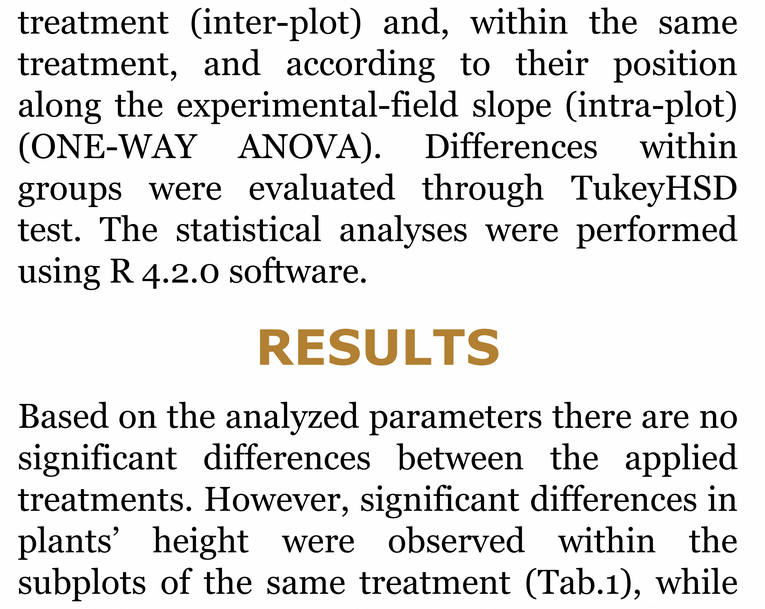

Fig.1. The drawing shows the experimental design applied in the study (orange: standard compost, white: no compost and, green: compost + bioplastics). For each of the treatments, 1000 kg of compost have been distributed along 500 m^2. The soil sampling and the harvesting activities have been performed in the center of each plot, within the yellow area. Drawing kindly provided by Dr. Antonella Petrini (CERMIS).

Table.1. The table reports the results of the statistical analyses conducted on plants height. Significant differences were found when considering subplots of the same treatment (signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1).

Intraplot	ONE WAY ANOVA (p-value < 0.05)	TukeyHSD (p-value < 0.05)	
OFMW	1.88e-07 ***	**2-1** 0.9167438	**4-2** 0.0026462**
		3-1 0.0154271*	**5-2** 0.0000185***
		4-1 0.0001911***	**4-3** 0.5946031
		5-1 0.0000011***	**5-3** 0.0336414*
		3-2 0.1178659	**5-4** 0.5395596
OFMW-BP	1.73e-07 ***	**2-1** 0.0062179**	**4-2** 0.9259149
		3-1 0.0001504***	**5-2** 0.0053456**
		4-1 0.0005337***	**4-3** 0.9947281
		5-1 0.0000000***	**5-3** 0.1145148
		3-2 0.7485365	**5-4** 0.0467315*
CONTROL	8.85e-09 ***	**2-1** 0.9365748	**4-2** 0.1613481
		3-1 0.5387861	**5-2** 0.0000003***
		4-1 0.0274615*	**4-3** 0.5449996
		5-1 0.0000000***	**5-3** 0.0000037***
		3-2 0.9374955	**5-4** 0.0005949***

CONCLUSIONS

The experimental field considered is located on a hillside and present a high level of soil heterogeneity. Thereby, the differences could be related to the distribution of the plots along the field's slope compared to the treatments. However, ear size and chlorophyll content didn't' show any significant difference when compared both inter and intra-plot. Next step will be the assessment of the possible impact of the different composts on the wheat rhizosphere communities by 16S and ITS rRNA genes using metabarcoding approaches.

Fig.2 Flowchart of the production of the OFMW-BP. The compost was distributed in 0–25 cm layer of soil, one month before sowing the wheat.

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