

Introduction

Plastic debris can enter soil systems through several pathways. Recent studies have highlighted a wide range of impacts of microplastics (MP) on soil physicochemical properties, soil fauna, and potential adverse impacts on terrestrial plants. Besides, the knowledge of soil microbial activity is limited, particularly concerning the interactions between MP and the soil microorganisms.

Furthermore, few studies assessed the impact of the direct incorporation of plastic residues on soil temperature. This information is crucial, as microplastics may indirectly affect soil properties and soil functions through temperature changes.

Objectives

The main objective of this study was to assess if (micro)plastics incorporated into the soil can act as heat retainers and if they can subsequently have adverse impacts on soil physical, chemical and biological properties.

Materials and methods

- Experiment duration: five months and two experimental time points.
- Experimental design: Plot of 7x7m that consisted of 12 sub-plots (50 x 50cm) separated by 1 m (Fig. 1).



Fig 1 – Experimental field

- Four treatments (3 replicas each):

Control (no plastics), Black (black plastic mulch), White (greenhouse plastics), and olive-grey (plastics from oxo-biodegradable bags).

- For each treatment: 100 plastic items (4-50 mm) buried in the topsoil (0-5 cm).
- Infrared thermography was used to assess the thermal patterns in each plot. Analyses carried out at 10 am, 1 pm and 4pm, after 1 month and 5 months of plastic addition to soils.

Results and discussion

- Before soil temperature measurements were obtained, the heat retained and released by each type of plastic when exposed to the sunlight was measured by infrared thermography (Fig. 2).

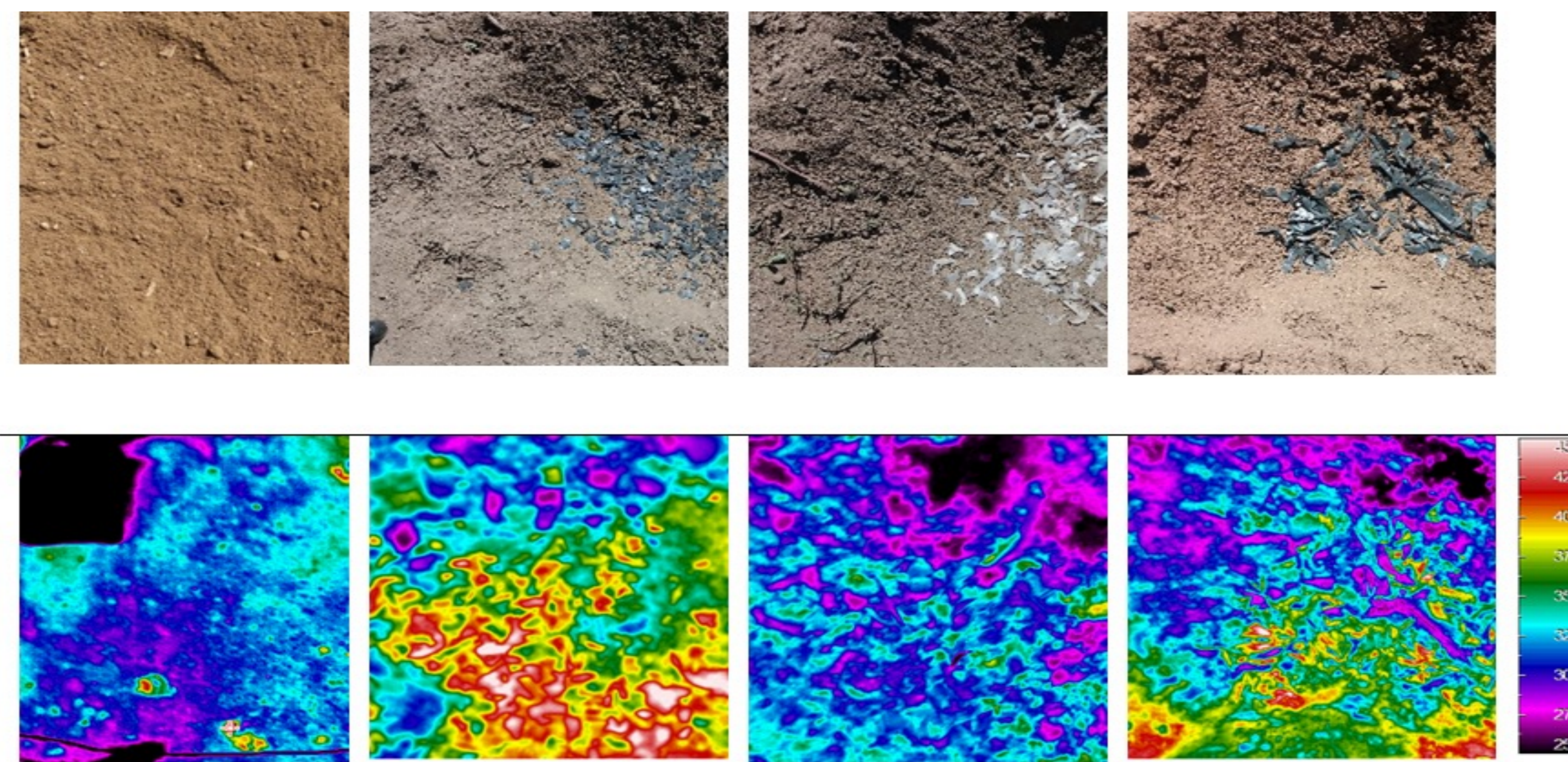


Fig 2 - Plastic items used in this study, their thermal images and temperature of plastics without being incorporated into the soil (From left to right: control, black, white and grey treatment, respectively):

- Soil surface with black plastic showed the highest average temperature ($39.08 \pm 3.34 \text{ }^\circ\text{C}$) > oxo-biodegradable (olive-grey colour) ($35.45 \pm 3.19 \text{ }^\circ\text{C}$) > white plastic ($31.82 \pm 2.07 \text{ }^\circ\text{C}$).
- Differences in temperature associated with the different colors of the plastics, which influences the short-wave absorption coefficient, were recorded.

- Soil thermal patterns and temperatures were, on average, extremely similar between the different experimental times and among the treatments (Fig. 3).

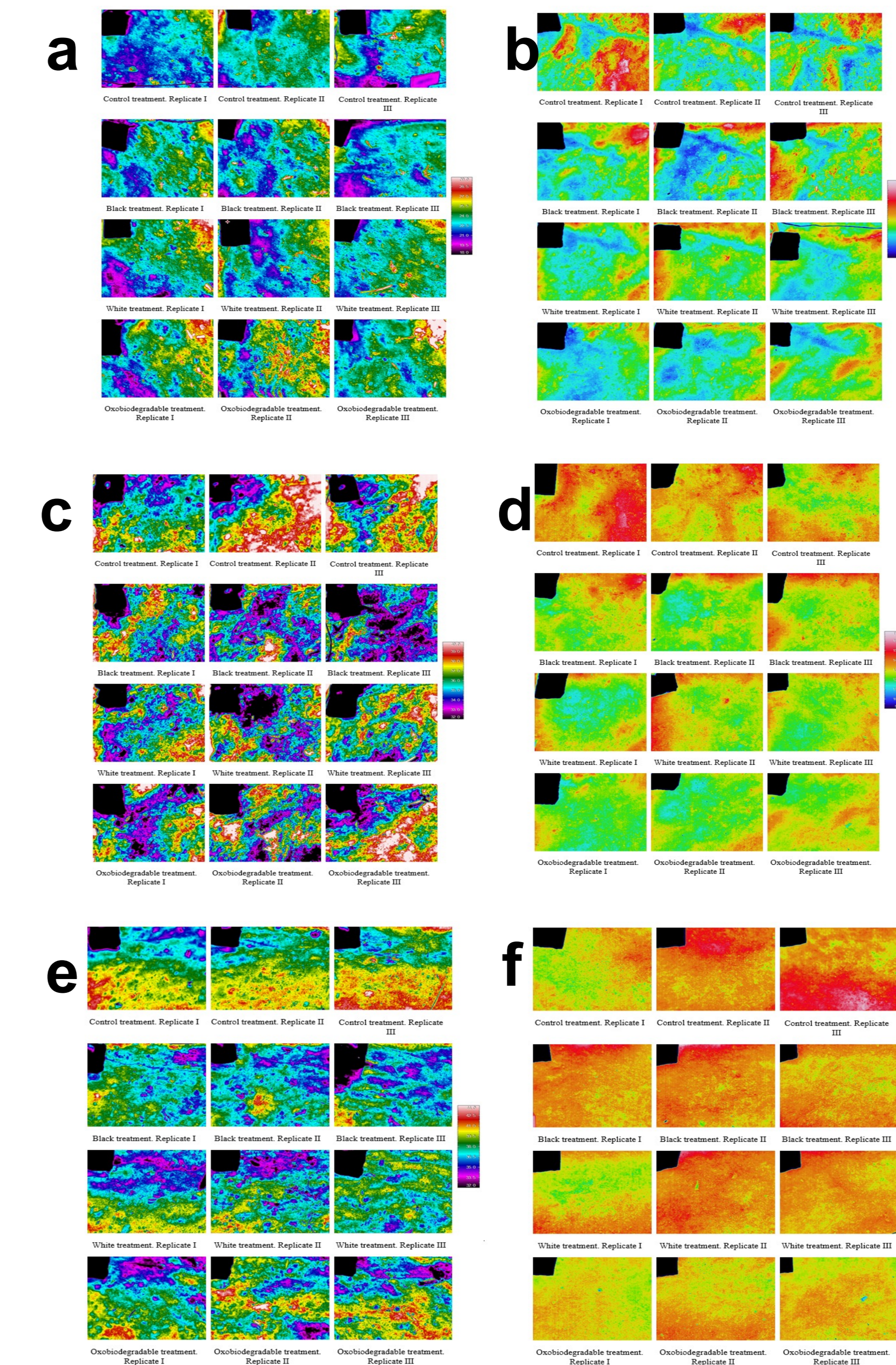


Fig. 3 - Thermal images of the three replicas of the four compositions evaluated in the beginning of the experiment (a, c, e) and at the end of the experiment (b, d and f) at 10 am, 1 pm and 4 pm, respectively.

Conclusions

- These results suggest that plastics that are incorporated into the first cm of the topsoil do not act as heat retainers.
- The impact of soil microbial activity and the colonization of soil microorganisms on plastic buried in the topsoil is under study.

Acknowledgements

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