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Effects on soil chemical and biochemical status from recycling organic wastes to agricultural land: results from a field experiment

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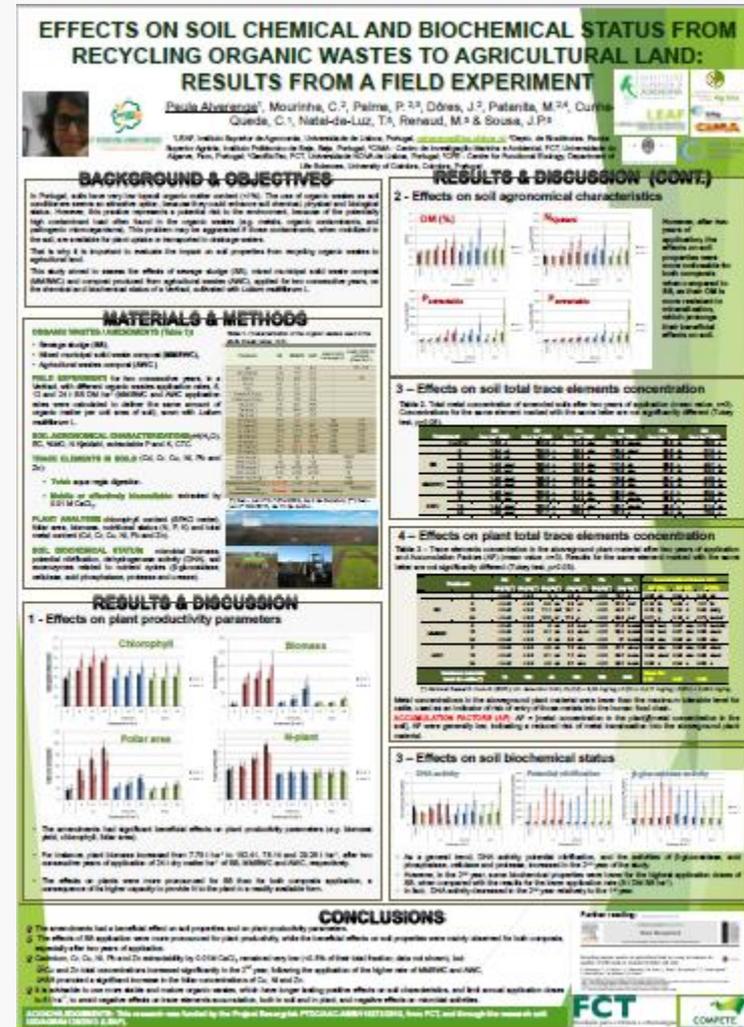
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Background & Objectives

It is important to evaluate the impact on soil properties from recycling organic wastes to agricultural land.

This study aimed to assess the effects of **sewage sludge (SS)**, **mixed municipal solid waste compost (MMSWC)** and **compost produced from agricultural wastes (AWC)**, on the chemical and biochemical status of a Vertisol, cultivated with *Lolium multiflorum* L.



Materials & Methods

A field experiment was set up for two consecutive years, with the different organic wastes (SS, MMSWC and AWC), applied at 6, 12 and 24 t DM ha⁻¹, using *Lolium multiflorum* L., assessing:

- **SOIL AGRONOMICAL CHARACTERIZATION:** pH(H₂O), EC, %MO, N Kjeldahl, extractable P and K, CTC.
- **TRACE ELEMENTS** (Cd, Cr, Cu, Ni, Pb and Zn): **Total:** aqua-regia digestion. **Extractable:** by 0.01 M CaCl₂.
- **PLANT ANALYSIS:** chlorophyll content (SPAD meter), foliar area, biomass, nutritional status (N, P, K) and total metal content (Cd, Cr, Cu, Ni, Pb and Zn).
- **SOIL BIOCHEMICAL STATUS:** microbial biomass, potential nitrification, dehydrogenase activity (DHA), soil exoenzymes related to nutrient cycles (β -glucosidase, cellulase, acid phosphatase, protease and urease).



Results & Discussion

- The amendments had a beneficial effect on soil properties and on plant productivity parameters.
- The effects of **SS application were more pronounced for plant productivity**, while the **beneficial effects on soil properties were mainly observed for both composts**, especially after two years of application.
- Cadmium, Cr, Cu, Ni, Pb and Zn extractability by 0.01M CaCl₂ remained very low (<0.5% of their total fraction), but:
 - **Cu and Zn soil total concentrations** increased significantly in the 2nd year, following the application of the higher rate of both **composts**,
 - **SS** promoted a significant increase in the **foliar concentrations of Cu, Ni and Zn**.



Results & Discussion

As a general trend, DHA activity, potential nitrification, and the activities of β -glucosidase, acid phosphatase, cellulase and protease, **increased in the 2nd year of the study**.

However, in the 2nd year, **some biochemical properties were lower for the highest application doses of SS**, when compared with the results for the lower application rate (6 t DM SS ha⁻¹).

In fact, DHA activity decreased in the 2nd year relatively to the 1st year.

Conclusion

- **use more stable and mature organic wastes**, which have longer lasting positive effects on soil characteristics, and
- **limit annual application doses to 6 t ha⁻¹**, to avoid negative effects on trace elements accumulation, both in soil and in plant, and negative effects on microbial activities.

