Stability-associated variation of maturity and plant growth effects of composts

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Introduction

Compost drums

The length of composting is positively related with the stability of compost (Lasaridi and Stentiford, 1998), which is one of the most important compost characteristics with significant agronomic and commercial implications. The duration of composting is also negatively related to compost phytotoxicity (Tiquia, 2010), a term referring to the adverse effects of compost on plants. Compost incorporation in soil or growing media is associated with significant effects on plant growth variables, such as nutrient supply and root conditioning but the effect of compost age on them is not always at the same direction

Pot trays for germination tests

The work aimed in verifying the notion that the evaluation or ranking of finished composts in relation to stability is indicative to their evaluation or ranking in relation to maturity or plant growth effects). This study firstly verified whether there is a relationship between the age of compost and its biological properties using common assays of compost characterization and secondly investigated whether Oxygen Uptake Rate (OUR) estimates of three stable composts of different feedstock composition and the same initial C:N ratio could safely indicate the degree of their phytotoxicity and plant growth promotion.

Results & Discussion

Materials that are being composted are becoming more stable and less phytotoxic. The methodological approach used at the first experiment of the study was proved to be sensitive enough to track composting age effects and results indicated that materials at more advanced stages of composting were characterized by smaller OUR, smaller seed germination rates (Figure 1) and immobilized nitrogen after incorporation in soil more intensively than immature composts.

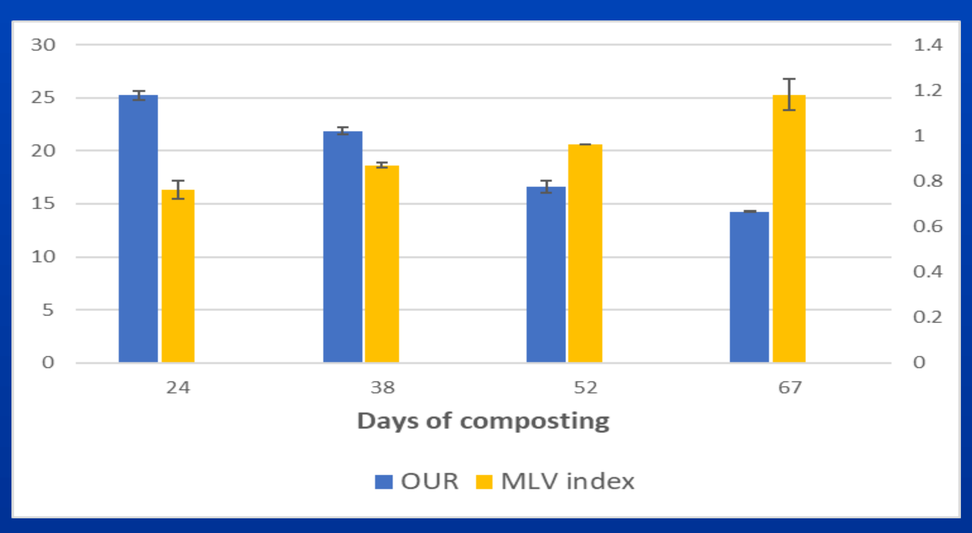

Figure 1

The three finished composts of different feedstock that were used during the second experiment, gave OUR results ranging between 4.5 and 12.8 mmol kg^{-1}OM h^{-1} and according to them composts ranked in the order: COMP3 > COMP4 > COMP2. When tested for phytotoxic effects the most stable COMP3 showed an almost complete restriction of germination. Interestingly, mixing composts with peat not only increased seedling growth, but also reduced or even removed their phytotoxic effects in such a way as to modify the compost ranking that was based on GI values (Figure 2). Apparently, either the dilution of chemical substances affecting toxicity or increased microbial degradation of them caused an important reduction of the negative effects of compost on plant growth In contrast, ranking of materials in relation to plant growth effects coincided with stability, but only after dilution with peat, which apparently reduced or even removed their phytotoxic effects.

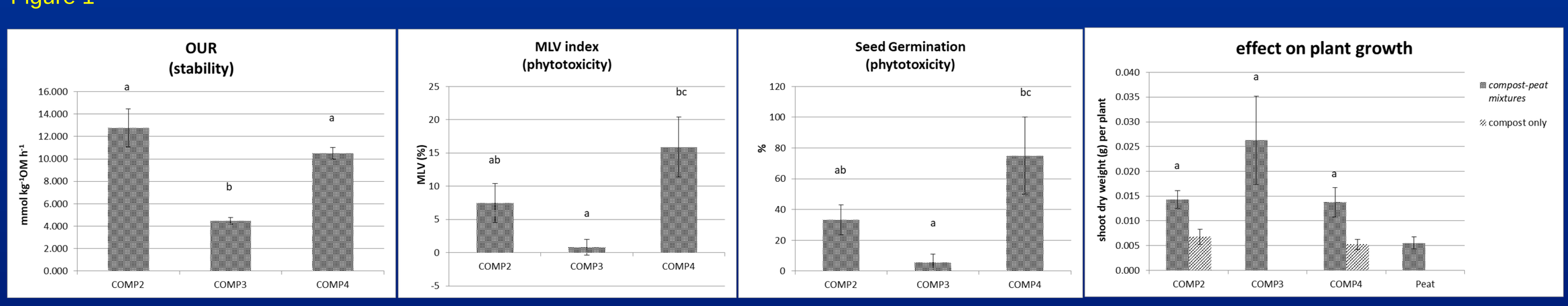

Figure 2

Conclusions

Stability and phytotoxicity did not correlate in this study as the most stable compost was shown to be also the most phytotoxic. An adequate assessment of compost effects on plant germination and growth requires the independent characterization not only of its stability but also its phytotoxicity and nutrient supply capacity, as the three biological properties of compost may not correlate to each other.