Long-term Urban Waste Compost Applications

INTRODUCTION

- Compost addition to the soil and tillage tends to affect physical properties and solute transport in the soil.
- Long-term applications of urban waste compost may lead to a significant accumulation of certain micropollutants in the soil.
- The organic waste products applied on the soil surface are not incorporated deep into the soil profile, because of the tillage practices, which could influence the transport of inorganic contaminants of low mobility like Cu or Cd.

OBJECTIVE

Numerical modeling was performed using HYDRUS-2D to estimate the movement of Cd and Cu from compost incorporation in the tilled layer. Experimental plots regularly amended with co-compost of sewage sludge and green wastes (SGW), or a municipal solid waste compost (MSW), or a control plot without any organic amendment (CONT).

MATERIALS AND METHODS

- Long-term field experiment *QualiAgro* [https://www6.inra.fr/qualiagro_eng/]: Abeluvisol (WRB); Crops: winter wheat (Triticum spp.); maize (Zea mays L.); barley (Hordeum vulgare L.).
- Water and TMs monitoring: 2 wick lysimeters, 5 TDR probes, and 7 tensiometers per plot.
- Ploughed layer structural description: compacted clods (A), non-compacted soil (F), interfurrows (IF), and the plough pan (PP).
- Different structural zones were implemented into HYDRUS-2D using optimized soil hydraulic properties.

RESULTS

Evolution of Cu concentrations in soil solution of the first 45 cm during 2005-2010 period including three compost additions in the SGW and MSW plots.

Evolution of Cd concentration in soil solution of the first 45 cm during 2004-2010 period including three compost additions in the SGW and MSW plots.

CONCLUSIONS

- Lysimeter data of Cu leaching were successfully reproduced by using first Kd-1 approach for SGW and CONT plots, while MSW plot showed less successful fitting (model efficiency E_{SGW}=0.97, E_{MSW}=0.37; E_{CONT}=0.95).
- The Cd leaching could be reproduced with the second Kd-2 approach for the two amended plots (E_{SGW}=0.55, E_{MSW}=0.80).
- The poorer fitting with the field data was attributed to less stable organic matter in MSW compost for Cu and by the overestimated influence of the low pH for Cd in the CONT case.
- Numerical modeling revealed interesting results in which, even with the high values of hydraulic conductivity in the IF zones, Cd and Cu showed low mobility. The TMs mobility in the tilled layer is largely reduced due to retention capacity of the applied composts.

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