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Effect of self-produced composts on lead uptake by lettuce from moderately contaminated soil of an urban allotment garden

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Abstract (max. 400 words)

The need for nature is a growing trend in cities and to satisfy in part this demand urban gardening including community gardens is increasing in many cities in the world. But these gardens are often observed on urban wastelands, along roads or railways, on former industrial sites. These urban soils can contain contaminants like trace metals and metalloids (TMM, such as As, Cd, Pb, and Zn) due to past or present urban activities but also gardeners practices.

Exposure to TMM in soils can lead risks to gardeners via ingestion/inhalation of soil particles or consumption of contaminated vegetables. In order to limit the risks, their phytoavailability could be reduced by remediation strategies like soil amendements. Organic amendments as compost can be used to immobilize or stabilize TMM.

Besides to contribute to improve the agronomic potential of soils, compost can potentially reduce the mobility of TMM and their uptake by vegetables by modifying pH and sorption capacity of the soil. In the context of home gardens, composts are usually used by gardeners and often self-produced. The specific effects of self-produced composts on TMM are poorly studied.

The aim of this study was to study three composts with contrasted elemental composition and biochemical properties: 1 community compost and 2 home composts. Two experiments under controlled conditions were conducted with lettuce (Lactuca sativa) with an urban home garden soil with moderate Pb contamination (106 $mg.kg^{-1}$). The self-produced composts were applied with doses ranging from 25 to 200 $t.ha^{-1}$. A municipal and an industrial compost were used as references. Trace element concentrations, pH, electrical conductivity and dissolved organic matter parameters were monitored in soil pore water over 70 days. Trace element contents were measured in lettuce roots and leaves after 35 days of growth.

In the soil pore water, trace element concentrations increased with the addition of the municipal, the community and only one home compost. The concentrations of Pb, increased 10-fold with 200 $t.ha^{-1}$ of community compost compared to unamended soil. Pb concentration in soil pore water was notably correlated with dissolved organic carbon (R^2=0.49, $p=1.10^{-4}$). In lettuce leaves, Pb content remained low and did not exceed the European regulatory threshold of 0.1 $mg.kg^{-1}$ fresh weight (EEC/R1881, 2006). But in roots, the content reached 0.6 $mg.kg^{-1}$ fresh weight and varied significantly with the type of compost and its dose. This could be a problem for root vegetables.