Title: Long-term terrestrial ecotoxicity of trace elements in a context of intensive organic fertilization in market garden crops

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Despite the induced contamination in trace elements by organic fertilization, either their availability and bioavailability to soil organisms do not seem to increase on a decade. This is due to a protective effect of the increase in pH and concentration and complexation properties of soil organic matters. On a longer term, it remains to be determined whether the observed protective effect will be sufficient to contain ecotoxicological impact of slow but continuous agricultural soil contamination.

In this study we determined the potential ecotoxicological impact on soil organisms in a market garden soil contaminated by trace elements (Cd, Cu, Ni, Zn) in a context of intensive organic fertilization on a century. Data were obtained from a field trial conducted from 2004 to 2011. Five market garden crops were cultivated and received biannual applications of either pig slurry or poultry manure in comparison to a reference mineral fertilization. A mass-balance model was used to predict trace element soil concentration on a century for the different fertilization treatments. The evolution on a century of the predicted no effect concentration (PNEC) was estimated using the Threshold calculator for metals in soil with the REACH approach (i.e. 10% of toxic effect – EC10 – and 5% of impacted soil organisms – HC5).

The results showed an increase in pH, organic matter and Cu and Zn concentrations in soil. The mass-balance model predicted well the observed trends of trace element concentrations in soil of the decade of monitoring. When extrapolating this intensive organic fertilization scenario on a century, the PNEC were not reached for Cd and Ni. Concerning Cu and Zn, the soil concentrations reached in average the PNEC values after 30 and 60 years. These results suggest that intensive organic fertilization may have an ecotoxicological impact on a few decades that should be further confirmed experimentally.