Responses to Referee 1 : MS No.: soil-2020-81

Title: Zinc lability and solubility in soils of Ethiopia – an isotopic dilution study

Author(s): Abdul W. Mossa et al.

Many thanks for your time and effort in reading and commenting on our manuscript; your detailed points will help improve it. In the following we address the individual points you raise.

Referee 1

1. Introduction (page 1, lines 39-41): this section, describing the quality and fertility of agricultural soils in the sub-Saharan Africa, needs to be widened with a focus on Zn geochemistry.

   Response:

   Thank you for your suggestion—we suggest adding a section to highlight the knowledge gap on Zn geochemistry in tropical soils from sub-Saharan Africa compared to temperate soils, as follow:

   > "However, trace metal dynamics in SSA soils are rarely studied. For example, a simple search of the Web of Science database using the key words "zinc solubility" and "soil" between 2010 and 2021 yielded 24 publications, none of which involved SSA soils. This is potentially a serious omission because Zn geochemistry in SSA soils is likely to differ from that in temperate soils because of differences in geocolloidal minerology, organic C content and the soil pH at which agriculture is practiced."

2. Although readers are referred to Gashu et al. (2020) for details on field sampling, I suggest providing a map of sampling area, at least as possible supplementary material. The overall methodology has to be better defined, analysing advantages and possible limitations as well.

   Response:

   Thank you for your suggestion— we propose adding a map showing sampling location to the revised manuscript:

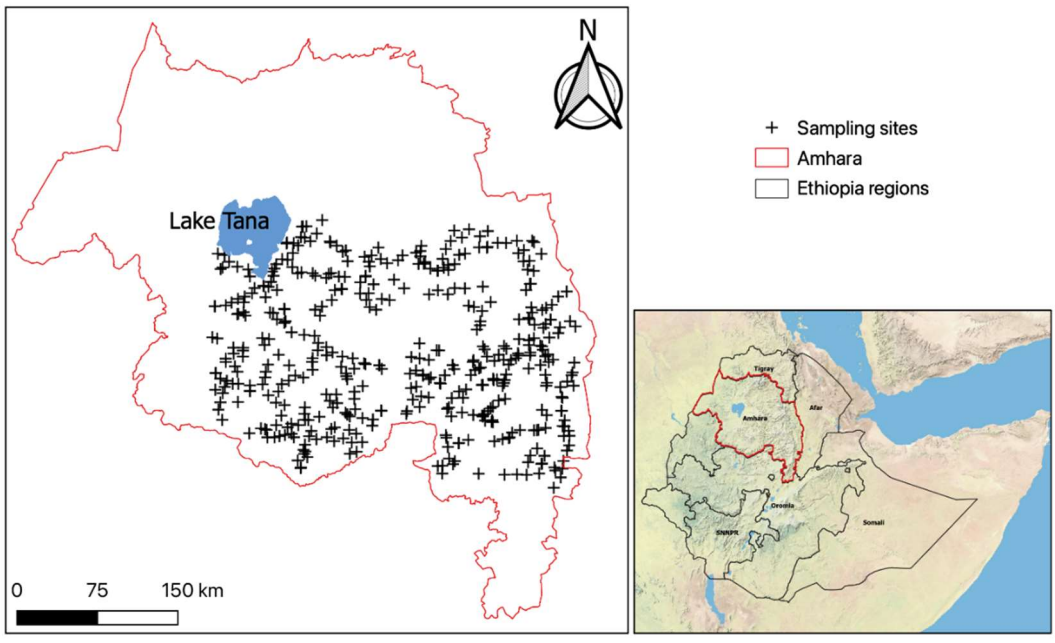

Figure 1. Location of sample sites (black crosses) relative to the border of Amhara region (red line), Ethiopia

3. Did authors analyse any certified reference materials? Please provide more details on quality control and quality assurance of soil extractions.

Response:

There are no certified materials for most of the extractions used in the study. We used the reference material (ISE 962) provided by Wageningen Evaluating Programs for Analytical Laboratories (WEPAL) for aqua regia extraction. We suggest adding the following details to the revised manuscript:

> "Blanks and in-house standards were included in each extraction run and calibration standards were checked using independent certified calibration verification standard solutions. Soil reference material ISE 962 purchased from Wageningen Evaluating Programs for Analytical Laboratories (WEPAL) was used to confirm the reliability of the Aqua regia extractions. Recovery of Zn was 91.3% ± 2.35%. Repeat extractions and analysis was undertaken on 10% of the samples."

4. If possible, gather and show the main operating parameters of the ICP-OES and ICPMS instruments in a table in the supplementary section.

Response:

Thank you for your suggestion— we propose to add the following table of main operating parameters of ICP-MS instruments to supplementary material.

Table S1. ICP-MS (iCAP-Q) operating conditions for both multi element and isotope ratio

Parameter	Isotope analysis	Multi-elements analysis
Dwell time (s)	0.05	0.01
Number of sweeps	50	50
dead time correction (ns)	34.7	34.7
Detector dead time (ns)	35	55
Nebuliser flow rate (L min^{-1})	1.120	1.105
Extraction lens voltage (V)	-176.5	-111.3
Helium flow rate (L min^{-1})	4.4	4.4
Coolant gas flow (Ar; L min^{-1})	14	14
Auxiliary gas flow rate (L min^{-1})	0.8	0.8
Spray chamber temperature (°C)	2.7	2.7

5. 3.1 section: classification of study soils according to World Reference Base for Soil Resources could be useful for potential readers.

Response:

Thank you for your suggestion—we suggest adding a list of the most common soil types in the study area to the revised manuscript, as follow:

> 'Fluvisols, Leptosols, Lixisols, Luvisols and Vertisols are the prominent soil types in the study area (Dewitte et al., 2013)'

6. 3.1 section: in the PCA figure 2, it seems evident as DTPA-extractable concentrations are significantly and positively correlated with total concentrations of Zn in soil, while Ca(NO3)2-extractable concentrations are not. Can you try to explain this erratic behaviour?

   Response:
   DTPA extraction, a measurement of 'quantity', is expected to better correlate with total concentration in soil. On the contrary, the extraction in $Ca(NO_3)_2$, a measurement of 'intensity' or 'solubility', is more likely to depend on soil properties, chiefly soil pH. Therefore, it is not unexpected that Zn solubility (in 0.01 M Ca nitrate) is largely independent of the total concentration in soil whereas DTPA-extractable Zn reflects the total Zn concentration to a greater degree.

7. 3.4 section (line 341-343): consider adding this recent reference https://doi.org/10.3390/agronomy10091440

   Response:
   Thank you for your suggestion—we will add this reference to the revised manuscript.

8. Conclusions (line 402): use both/and. Alternatively, either/or.

   Response:
   Thank you—for more clarity, we will add 'or' to the revised manuscript at line 439.