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Sustainable management of a tropical post-tin mining soil - Crop yields and heavy metal concentrations as affected by soil local amendments

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Heavy metal contaminations in post-mining areas present a toxicological challenge for the surrounding environment and human health. Hence, this field study on post-tin mining area investigates five different soil amendments: (1) dolomite; (2) compost; (3) charcoal as well as combinations of (4) charcoal+compost; and (5) charcoal+sawdust; and a control for local crops (*Cassava* and *Centrosema pubescents)* performance and heavy metal (HM) concentrations in soils and crops.

Total HM concentrations in soils and crops were strongly effected by amendments, however, element specific. Post-mining soils amended with charcoal+compost increased Fe, Zn, Cu, and Hg concentrations by high HM concentrations in compost. However, the pure charcoal amendment reduced Cr concentration in soil. Organic soil amendments improved crop yields, but the bioaccumulation of selected HM in crops varied. Dolomite amendment reduced Pb bioaccumulation in cassava by 30%; and pure charcoal also lowered Cu in cassava, as well as Cd and Pb in centrosema by 14 and 4% respectively. Whilst combined amendment with charcoal+compost showed the greatest reduction in Cd (65%) and As (23%) in cassava. Contrarily, higher bioaccumulation of some heavy metals was observed, in particular charcoal, compost, and combined their amendment increased Fe, Zn, and Pb in cassava. Charcoal+sawdust also increased Fe, Cu, Zn, Pb, and Cd in centrosema. The bioaccumulation factor (BAF) for Cu, Zn, and Pb in cassava and centrosema was greater than one (BAF>1) indicating these crops are hyperaccumulators under the respective environmental conditions, which could be reduced for Pb using dolomite as well as with the charcoal+compost amendment for Cu, Zn, and As.

In conclusion, the post-mining soils are rich in some heavy metals that can even be boosted with locally available organic amendments. However, their potential to increase crop yields and reduce bioaccumulation, need to be considered, particularly for Pb, As, and Cd concentrations in crops, that exceed international regulations for the maximum allowable limit in food, and thus help to prevent potential negative consequences for the environment and human health. The soil amendments are suitable remediation practice for increasing crop yields, but their quality is critical in tropical post-tin mining areas due to heavy metals content.