Tropentag, September 11-13, 2024, hybrid conference

"Exploring opportunities …
for managing natural resources and a better life for all"

Understanding the micro-nutrient chain in northern Ghana

Chike Madueke[1], Amisu Mohammed[2], Mouinou Igue[3], Vincent Avornyo[2], Ludger Herrmann[1]

[1] *University of Hohenheim, Soil Chemistry and Pedology, Germany*
[2] *University for Development Studies, Dept. of Soil Science, Ghana*
[3] *Inst. National de Recherche Agricole du Bénin (INRAB), Benin*

Abstract

In 2021, it was reported that up to 70 % of the population of sub-Saharan Africa suffer from the impacts of food insecurity and hunger. This is made even more acute by hidden hunger that is mainly caused by micro-nutrient deficiency, cannot be felt, with symptoms – such as fatigue, inappetence, skin diseases, Immunodeficiency, etc. – not easy to decipher. The resultant mental impairment, low productivity, increased morbidity/mortality, especially among children less than 5 years old, would usually have occurred before the need for corrective measures is even noted. The effective nutrients, including copper, iron, manganese, molybdenum and zinc, are largely soil-borne. If these soil micro-nutrients were available in adequate amounts, food and fodder plants could absorb them, leading to adequate human uptake for healthy growth and survival. Consequently, a good knowledge of the spatial distribution of these micronutrients would enable site-specific soil management and fertilisation for improved human, animal, and plant nutrition. Unfortunately, data on soil micro-nutrients is grossly inadequate in sub-Saharan Africa. Therefore, the major objective of this study is to develop a methodology for easy/rapid mapping of soil micro-nutrient distribution. For this case study, about 100 soil samples were taken along a 290 km road transect covering different geological/petrographical areas in Northern Ghana. The samples were characterised with respect to mineral (X-ray diffraction), geochemical (X-ray fluorescence) and plant available micro-nutrients (DTPA-extraction) composition. Co-variables like texture, soil organic matter and pH are under investigation. Preliminary data for the plant available fraction show that iron (15–700 mg kg^{-1}) and manganese (8–625 mg kg^{-1}) are available in optimum to very high ranges. In contrast, copper content was predominantly very low ($<$ 0.30 mg kg^{-1}) to low (0.30–0.75 mg kg^{-1}), while zinc and molybdenum were generally deficient, i.e. below 5 and 0.05 mg kg^{-1} respectively. Soil fertility management programmes should consequently be targeted at improving the nutrient status of copper, zinc and molybdenum in the investigated area. Next steps are i.) the development of an extrapolation algorithm based on proximal/remote sensing gamma spectrometry data, and, ii. the determination of the transfer rate of soil micro-nutrients into food and fodder plants.

Keywords: Gamma spectrometry, hidden hunger, proximal and remote sensing, soil mapping

Contact Address: Chike Madueke, University of Hohenheim, Soil Chemistry and Pedology, Emil-Wolft-Str. 12a, 70599 Stuttgart, Germany, e-mail: chikeonyeka.madueke@uni-hohenheim.de