Why Do Agronomists Measure Leaves and Not Food? A Neglected Food Security Issue

Sahrah Fischer[1], Thomas Hilger[1], Hans-Peter Piepho[2], Irmgard Jordan[3], Georg Cadisch[1]

[1] *University of Hohenheim, Inst. of Agric. Sci. in the Tropics (Hans-Ruthenberg-Institute), Germany*
[2] *University of Hohenheim, Inst. of Crop Science, Germany*
[3] *Justus-Liebig University Giessen, Center for International Development and Environmental Research, Germany*

Abstract

Crop nutrient deficiencies are often determined based on leaf nutrient composition and their effect on yield, and less on edible part composition. Since leaves and edible parts of plants often have different plant functions and therefore different nutrient requirements, it remains unclear whether leaf nutrient composition can be used to draw conclusions on the nutrient composition of edible parts. Farm management and environmental factors such as water availability and soil fertility, may therefore have unknown consequences for the nutrient concentration of the edible part. Our main aim, therefore, was to investigate the relationship between trace element nutrient concentrations in leaves and edible parts (grain, tuber, and fruit) of three staple food crops.

Leaf and edible part samples of maize (*Zea mays* L.) and cassava (*Manihot esculenta* Crantz) from a poor fertility soil (Teso, Kenya), and maize and matooke (*Musa acuminata* Colla) from a higher fertility soil (Kapchorwa, Uganda) were collected. Concentrations of macronutrients Mg, P, S, K, and Ca and micronutrients Fe, Mn, Cu, and Zn were measured using a portable X-Ray Fluorescent Spectrometer (pXRF). Leaf and edible part nutrient concentrations were compared to yield and to each other using a bivariate linear mixed model fitted with residual maximum likelihood (REML) to calculate the marginal correlation.

Nutrient concentrations of leaf (y(1,2)   0.20) and edible parts (y(1,2)   - 0.20) showed the least similarity to yield in low fertility soils, meaning that leaf measurements can give less indication of edible part nutrient concentration on low fertility than high fertility soils. Nutrients with a low phloem mobility such as Fe, Mn, Ca, Cu, and Zn showed the largest difference in correlations to yield, compared to the other macronutrients. Correlations varied between nutrient concentrations in different plant parts depending on the type of nutrient, the type of crop, and the type of plant part in question. Leaves did not provide enough information to gauge both yields and quality of foods, particularly regarding micronutrients. Agronomists targeting the production of foods for human consumption should begin analysing the produced food quality to ensure adequate food nutrient concentrations.

Keywords: Food quality, human nutrition, plant nutrition, trace elements

Contact Address: Sahrah Fischer, University of Hohenheim, Inst. of Agric. Sci. in the Tropics (Hans-Ruthenberg-Institute), Garbenstr. 13, 70599 Stuttgart, Germany, e-mail: sahrah.fischer@uni-hohenheim.de