

Mineral micronutrient density characterization using energy dispersive x-ray fluorescence (XRF) analysis in four on-farm Kenyan wild African fruit tree germplasm

Abstract:

Kenya has over 400 marginalized indigenous fruit species. A majority found in natural habitats are allegedly high in micronutrients that could help mitigate the prevailing micronutrient nutrahealth deficiencies. Amplifying their nutrahealth value more as nutraceutical than wild species, and coupled with local level community centered promotion for use and conservation, could stimulate the uncommon opportunities for decentralized and locale-specific community use and conservation. Thus conservation-by-use could enlarge the nutrahealth security basket as well as mitigate loss of the vanishing fruit species. In retrospect, value-adding nutrahealth research is needed to change the un-informed mind. Thus, the objectives of the study were to: (1) tag Mineral-Referred sites (MRS) influencing Fruit Mineral-Density variation (FMDVAR) among Grewa, Rhus, Boabab and Jackfruit accessions; and (2) apply a nutrametric value (grading) test to classifying FMD variation (FMDVAR) within the realm of nutraceutical food, nutrition and health promise. Fruit portions with their tree trunk adjoining soils were collected in 2003/04 from Kanduyi-Chwele- Nalondo (Bungoma) transect; Maseno-Esivalu (Maseno); and Kaseme-Masongaleni (Kibwezi) and subjected to XRF analysis at the Institute of Nuclear Science and Technology in the University of Nairobi. A Clustered-Bar-Graphing test was used to obtain Ca, K, Fe, Zn, Cu, Mn as variation-picking elements which were turned into MRS X-variables upon which fruit species mineral-density variation was determined. Significant ($p < 0.05$) FMDVAR x MRS and phyto-region x FMDVAR interactions were detected. Rhus spp had the highest Fe-Mn > Grewa spp > Jackfruit > Ficus > Boabab spp depending on locations they were collected from. In that order, Ficus showed the highest iron-manganese but had the lowest Zn-Cu. Jackfruit, with Fe-Mn third in line, had highest Zn-Cu. There was no accession with ♦all-winner♦ elements. In density terms some minerals were top while others were variably low. High uptakeability of elements in the tree species such as demonstrated by Rhus may be indicative of their soil-mining (a depletion effect) and/or fruit accumulation (a nutra-health plus) tendency. On the overall, nutrametric valuation (NTV) confirmed that Rhus and Ficus had highest fruit micronutrient variation relative to Jackfruit and Boabab. NTV clusters did not show a one-to-one soil-to-plant element matching between plant and soil mineral content. Plant micronutrient patterns show the potential for exploiting the indigenous trees for development of nutrahealth cropping.