Relationships between Total Mineral Element Concentrations of Major Paddy Growing Soils in Sri Lanka

N.D.R. Madushan[1], E.M.S. Ekanayake[1], N.A.S.A. Neththasinghe[1], D.A.T. Samarasinghe[1], W.M.U.K. Rathnayake[2], D.N. Sirisena[2] and L.D.B. Suriyagoda[1]*
[1]Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka
[2]Rice Research and Development Institute, Department of Agriculture, Batalagoda, Sri Lanka
*lalith.suriyagoda@gmail.com

The knowledge on the accumulation of essential and toxic trace elements in rice growing soils is crucial for sustainable soil nutrient management and rice crop production. The aim of the present study was to investigate the total concentration of essential and toxic trace elements and their relationships in Sri Lankan paddy soils. Two hundred soil samples were collected representing three climatic zones and seventeen soil types using stratified random sampling approach. The total elements concentrations were measured using X-ray florescence (XRF) analyzer. The minimum and maximum total element concentrations were determined using descriptive statistics. Relationships among total element concentrations were tested using correlation and principle component (PC) analyses, and the concentrations of elements among climatic zones and soil types were compared using ANOVA. The highest mean total element concentration in soil samples was recoded in Fe which ranged from 220 to 71,994 mg kg^{-1} followed by K (316-31, 153 mg kg^{-1}) and Ca (44-19, 436 mg kg^{-1}). The lowest mean total concentrations were observed in As and Mo (<3 mg kg^{-1}). Soil Fe concentration was positively correlated with Mn, Cu, Zn, As and Pb (r > 0.5, $p<0.05$). Among the climatic zones, Wet Zone soils (WZ) contained higher concentrations of Fe, Zn, As and Pb whereas Dry Zone and Intermediate Zone soils had higher concentrations of Ca and K compared to WZ soils. When compare different soils categories, Bog and Half-Bog soils and Red-Yellow Podzolic soils had higher Fe, Zn, As and Pb concentrations whereas lower concentration of Ca and K were observed. The highest Mn concentration was in Grumusols while Cu concentration was relatively uniform in all soil types tested. Elements concentrations and their relationships studied in this research would be important in sustainable nutrient management in Sri Lankan rice fields.

Keywords: Heavy metals, Macronutrients, Micronutrients, Trace elements, XRF