

Impact of Topography and Land Use on Spatial Distribution of Selected Trace Elements in a Sub-Catchment of Seethaeliya-Sri Lanka

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Trace element could present in soils naturally. Their concentrations in soils enhance due to anthropogenic activities (i.e. residential, industrial and agricultural activities). In agricultural soils, when the concentrations exceed the threshold levels, trace elements could adversely affect human health via food contamination. Seethaeliya area in Nuwara Eliya administrative district is a typical example where an intensive vegetable production with heavy usage of agrochemicals is practiced. The level of soil contamination in this area and the effect of land use and the topography on soil contamination have not been studied. This study was conducted to explore the spatial variability of arsenic (As), cadmium (Cd), copper (Cu) and lead (Pb) in soils in a sub-catchment in Seethaeliya and the impact of two types of agricultural land uses (Tea and Vegetable) and topography on their concentrations in soils. Sixty topsoil (0-30cm) samples were obtained representing vegetable (n=30) and tea (n=30) land uses within a sub catchment. Air-dried and sieved (2 mm mesh) samples were extracted in Aqua-Regia and subsequently, lead (Pb), copper (Cu) and cadmium (Cd) were analyzed using atomic absorption spectrophotometer (AAS) and arsenic (As) was analyzed using hydride generation-AAS. Accuracy of analysis was assured using standard reference materials. Average Pb, Cu, Cd and As concentrations in soils from vegetable grown lands were 40, 37, 2.2 and 6.8 mg/kg respectively. Tea grown soils showed slightly different concentrations of Pb (39.9 mg/kg), Cu (45.9 mg/kg) Cd (2.1 mg/kg) and As (8.3 mg/kg). Independent t-test results revealed significant difference ($p < 0.05$) in Cu and As levels between vegetable and tea land uses. However, none of trace elements exceeded the critical levels identified by United States Environmental Protection Agency (USEP, Pb=150 mg/kg, Cu=750 mg/kg, Cd= 20mg/kg and As=21mg/kg) and the European Union (EU, Pb= 50-300 mg/kg, Cu=50-140mg/kg, Cd=1-3 mg/kg and As=50mg/kg). However, Cd concentration in soils were close to the limit of EU. More research is required to assess its' bioavailability. Regression analysis revealed poor linear relationships ($R^2 < 0.1$) between elevation and concentrations of trace elements. Topography has no control on the spatial distribution of trace elements, but land use has an effect on the soil Cu and As distributions.

Keywords: Heavy metals, Toxicity, Agro chemicals, Contamination of Soil, Vegetable cultivations, Tea cultiva. ෆs, Soil pollution.