



Plant uptake and soil retention of radionuclides and metals in vineyard environments

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Abstract

In most European countries, each adult citizen drinks on average more than 20 L of wine every year. Three popular wine-growing areas (Aleksandrovac, Topola, and Orahovac) in Serbia were studied in order to investigate the abundance and uptake of elements from vineyard soil to plants. The specific activities of radionuclides (^{226}Ra , ^{232}Th , ^{40}K , ^{137}Cs , and ^7Be) were measured in soil, leaves, and grape berries. ^{226}Ra and ^{232}Th were positively correlated with silt and clay and negatively correlated with sand content in soil. Specific activities of natural radionuclides were also negatively correlated with soil pH and CaCO_3 . Significant correlations of ^{40}K and ^{137}Cs with organic matter in soil were found. Concentrations of fifteen metals (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Zn, Fe, K, Na, Ca, Mg, and Hg) were also measured in soil samples as well as in grapevine leaves. Analyzed soils were rich in Ni, Cu, Co, Cr, and Cd. High concentrations of Cu were probably caused by long-term use of Cu-based fungicides. Cu was correlated with Fe and organic matter content in soil. Soil-to-plant transfer factors (TF) were calculated to estimate the uptake of radionuclides and metals. Correlations obtained via PCA enable distinction between the sites Aleksandrovac and Topola relative to Orahovac. The first principal component (PC1) accounting for 30.70% of the total variance correlated significantly with soil pH (H_2O), contents of CaCO_3 , Na, Ca, ^{40}K , and ^{226}Ra in soil, as well as with ^{226}Ra , Na, Ca in plants and TF_{Ca} . The second principal component (PC2), with total variance of 17.21%, was mainly correlated with variables pertaining to Mg, Co, and Cr in the soil and TF_{K} .

Keywords Vineyard · Soil · Radionuclide · Metal · Transfer factor · Correlation

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