

BIOGEOCHEMICAL MAPPING OF PHYTOAVAILABLE ARSENIC, CADMIUM AND LEAD IN ITALIAN AGRICULTURAL SOILS

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The geographical distribution of phytoavailable arsenic, cadmium and lead in Italian agricultural soils was investigated using wheat as a test plant. More than seven hundred samples of wheat grains were collected in the majority of Italian agricultural areas and pooled into composite samples, homogeneous with respect to geographical origin and wheat variety. Representative samples were obtained by applying pre-established criteria for the collection of individual samples and their grouping into composite samples. The number of individual samples was proportional to the surface under cultivation in each region, and only the prevailing wheat varieties in each growing area were selected. Arsenic, cadmium and lead concentrations were determined by ICP-MS after grain cleaning, grinding and closed-vessel microwave digestion of the resulting flour. Geographical variability of arsenic, cadmium and lead concentrations in wheat was studied considering the provinces (i.e., administrative districts) as reference areas. The spread of element concentrations was high and appeared to be related to spatial variability associated with geochemical and environmental factors. Since this apparent spatial variability could be biased by the temporal variability of element levels, i.e. year-to-year fluctuations of element concentrations in wheat at each location, a 3-year longitudinal study on 7 wheat cultivars grown in 22 areas of central and northern Italy was carried out. Average year-to-year variations in element levels were low, demonstrating a minor bias due to the specific sampling year. These results show that mapping of phytoavailable arsenic, cadmium and lead in agricultural soils can be done by measuring arsenic concentration in representative samples of wheat grains. The biogeochemical maps were obtained by calculating the deciles of mp distribution, where mp represents the arithmetic mean of element concentrations in wheat for each province. The relations between the different elements were investigated and are discussed as well

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