

Cadmium content in soils and in Oriental tobacco leaves: a study in tobacco-growing regions of southeast Bulgaria

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Over the last decades, concerted efforts to decrease tobacco consumption worldwide have been made. There is an extensive body of research on the content of harmful substances in tobacco raw materials and in cigarette smoke. Data on the statistical relationships between the heavy metal content in soils and in tobacco plants are of interest. For this study, 38 soil samples and 38 samples from mature Oriental tobacco leaves from the Eastern, Central, and parts of the Western Rhodope Mountains in Bulgaria were collected. Inductively coupled plasma atomic emission spectroscopy was used to measure the DTPA-extractable forms and total content of the element Cd in soil, as well as the concentration of Cd in tobacco leaves. The basic soil characteristics: pH, humus content, and texture were determined. The total content of Cd in the soils ranged from 0.15 mg/kg to 3.30 mg/kg; and the DTPA-extractable forms –from 0.02 mg/kg to 1.48 mg/kg. The Cd concentration determined in Oriental tobacco leaves varied between 0.05 mg/kg and 15.95 mg/kg. No visible symptoms of phytotoxicity were observed. Therefore, Oriental tobacco plants exhibited accumulating properties. The performed correlation/regression analyses revealed significant positive linear relationships between the total content and mobile forms of Cd in soils ($p < 0.001$). The concentration of Cd in the tobacco leaves was linearly proportional to the Cd content in soils: both for the total content and the mobile forms ($p < 0.001$). The power model adequately reflected the relationship between the mobile forms of Cd and the humus content. The same regression model described the relationship between the clay content and the Cd concentration in the tobacco leaves. The exponential model reflected the statistical relationships between the soil reaction (pH) and the content of Cd in the tobacco leaves; as well as the relationships between the DTPA-extractable forms of Cd with the clay ($< 0.002\text{mm}$) and the silt + clay ($< 0.02\text{mm}$) fractions of the soil.

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