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Study on Accumulation of Heavy Metals in Sweet Potato, Grown in Industrially Polluted Regions

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Abstract : A comparative research had been carried out to allow us to determine the quantities and the centers of accumulation of Pb, Cu, Zn and Cd in the vegetative and reproductive organs of the sweet potatoes and to ascertain the possibilities for growing them on soils, polluted with heavy metals. The experiments were performed on agricultural fields contaminated by the (1) Non-Ferrous-Metal Works near Plovdiv, (2) Lead and Zinc Complex near Kardjali and (3) a copper smelter near Pirdop, Bulgaria. The soils used in this experiment were characterized by acid, neutral and slightly alkaline reaction, loamy texture and a moderate content of organic matter. The total content of Zn, Pb, and Cd was high and exceeded the limit value in agriculture soils. Sweet potatoes were in a 2-year rotation scheme on three blocks in the experimental field. On reaching commercial ripeness the sweet potatoes were gathered and the contents of heavy metals in their different parts – root, tuber (peel and core), leaves and stems, were determined after microwave mineralization. The quantitative measurements were carried out with inductively coupled plasma atomic emission spectroscopy. The contamination of the sweet potatoes was due mainly to the presence of heavy metals in the soil, which entered the plants through their root system, as well as by diffusion through the peel. Pb, Cu, Zn, and Cd were selectively accumulated in the underground parts of the sweet potatoes, and most of all in the root system and the peel. Heavy metals have an impact on the development and productivity of the sweet potatoes. The high anthropogenic contamination leads to an increased assimilation of heavy metals which reduces the yield and the quality of the production of sweet potatoes, as well as leads to decrease of the absolute dry substance and the quantity of sugars in sweet potatoes. Sweet potatoes could be grown on soils, which are light to medium polluted with lead, zinc, and cadmium, as they do not accumulate these elements. On heavily polluted soils, however, (Pb – 1504 mg/kg, Zn – 3322 mg/kg, Cd – 47 mg/kg) the growing of sweet potatoes is not allowed, as the accumulation of Pb and Cd in the core of the potatoes exceeds the Maximum Acceptable Concentration. Acknowledgment: The authors gratefully acknowledge the financial support by the Bulgarian National Science Fund (Project DFNI DH04/9).

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