ADAPTATION STRATEGIES FOR SOIL AND WATER CONSERVATION IN A CHANGING WORLD

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Bořivoj Šarapatka, Marek Bednář and Patrik Netopil
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Impact of plastic pollution on the quality of arable soils in the Sava and Danube river valleys (Serbia)

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Plastic pollution is fast becoming a serious global environmental problem with the increase in plastic waste over recent decades. Plastic pollutants in the soil environment have an impact on the cycling of organic matter, global CO_2 production, crop production, and soil properties. Crop production in plastic greenhouses is one of the serious sources of plastic pollution in the environment all over the world and particularly in Serbia. One of the first investigations of plastic and microplastic materials in the soil on the territory of Serbia is currently underway and is being carried out within the project „Evaluation of the Microplastic in the Soils of Serbia – EMIPLAST – SoS" funded by the Science Fund of the Republic of Serbia. The aim of the research was to reveal the impact of the presence of plastic materials on soil's main chemical, physical and biological properties. Soil sampling was carried out in 2022 from two depths (0–15 cm and 15–30 cm), side by side from the plastic greenhouse and non-greenhouse agricultural production as a control in the first project year. The research sites are located on the alluvial plains of the two largest rivers in Serbia, the Danube and the Sava. The following chemical parameters were determined on all samples: electrical conductivity, pH, CEC, total C, as well as nutritional status of the soil (N, P_2O_5, K_2O, Cu, Zn, Mn and $CaCO_3$). Concentrations of some microelements were also analyzed. Physical parameters determined were: particle size distribution, volumetric mass, specific mass and porosity. Microbial respiration, which serves as an indicator of enzymatic microbial activity in the soil, was measured by the alkaline trap method from surface soil.

The values of electrical conductivity and pH were higher in all soil samples from plastic greenhouses compared to the control samples in both depths at both sites, while the measured values of CEC, carbon, nitrogen, P_2O_5, and K_2O are higher in samples from the control arable soils.The content of $CaCO_3$ was higher in the samples from the greenhouse compared to the control at both depths at the site in the Sava basin, while it wasn't significantly different in the samples from the Danube basin. The content of Cu, Zn and Mn was higher in the control samples at both depths in both sites, except for the sample from a depth of 15–30 cm from the location in the Danube basin where the Mn content is higher in the greenhouse. No significant difference in volumetric mass between the samples from the greenhouse and the control samples at both sites was detected. However, the specific mass, porosity, and particles >0.02 mm were higher in the soil from the greenhouse at both sites. The microbial activity expressed by soil respiration at the Sava basin wasn't significantly different between the plastic house and control arable soil. On the contrary, in the Danube valley respiration was by 78 % higher in the control samples compared to the samples from the plastic house. Preliminary results showed that soil chemical and biological properties are significantly affected by the presence of plastic materials in the arable soil in plastic greenhouses. In order to establish the level of the negative impact of microplastics (MP) on soil properties and microbial activity in the longer term, the study is ongoing. Further research is focused on the isolation of microplastics from river valleys' soils and their potentially detrimental effect on soil biogenicity and the environment. The results of the project will contribute to a better understanding of the biological and environmental effects of MP, which is very important for environmental safety.

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