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Phytoremediation Potential of Enhanced Tobacco BAC F3 in Soil Contaminated with Heavy Metals

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Abstract : A comparative study has been carried out into the impact of organic meliorants on the uptake of heavy metals, micro and macroelements and the phytoremediation potential of enhanced tobacco BAC F3. The soil used as part of this experiment was sampled from the vicinity of the Non-Ferrous-Metal Works near Plovdiv, Bulgaria. The pot experiment carried out consisted of a randomized, complete block design containing nine treatments and three replications (27 pots). The treatments consisted of a control (with no organic meliorants) and compost and vermicompost meliorants (added at 5%, 10%, 15%, and 30%, and recalculated based on their dry soil weight). Upon reaching commercial ripeness, the tobacco plants were gathered. Heavy metals, micro and macroelement contents in roots, stems, and leaves of tobacco were analyzed by the method of the microwave mineralization. To determine the elements in the samples, inductively coupled emission spectrometry (Jobin Yvon Emission - JY 38 S, France) was used. The distribution of the heavy metals, micro, and macroelements in the organs of the enhanced tobacco has a selective character and depended above all on the parts of the plants and the element that was examined. Pb, Zn, Cu, Fe, Mn, P and Mg distribution in tobacco decreases in the following order: roots > leaves > stems, and for Cd, K, and Ca - leaves > roots > stems. The high concentration of Cd in the leaves and the high translocation factor indicate the possibility of enhanced tobacco to be used in phytoextraction. Tested organic amendments significantly influenced the uptake of heavy metals, micro and macroelements by the roots, stems, and leaves of tobacco. A correlation was found between the quantity of the mobile forms and the uptake of Pb, Zn, and Cd by the enhanced tobacco. The compost and vermicompost treatments significantly reduced heavy metals concentration in leaves and increased uptake of K, Ca and Mg. The 30% compost and 30% vermicompost treatments led to the maximal reduction of heavy metals in enhanced tobacco BAC F3. The addition of compost and vermicompost further reduces the ability to digest the heavy metals in the leaves, and phytoremediation potential of enhanced tobacco BAC F3. Acknowledgment: The financial support by the Bulgarian National Science Fund Project DFNI H04/9 is greatly appreciated.

Keywords : heavy metals, micro and macroelements, enhanced tobacco BAC F3, phytoremediation, organic meliorants
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