

## **The Variation of Elemental Content and Bioactive Compounds of *Lactuca Sativa* L. Grown in the Presence of Multiwall Carbon Nanotubes Functionalized with Fe and Mn Oxides**

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The aim of this work was to evaluate the effect of six nanomaterials, namely CNT-COOH, CNT-MnO<sub>2</sub>, CNT-Fe<sub>3</sub>O<sub>4</sub>, CNT-MnO<sub>2</sub>-Fe<sub>3</sub>O<sub>4</sub>, MnO<sub>2</sub> and Fe<sub>3</sub>O<sub>4</sub> on the lettuce. In order to determine the impact of nanomaterials on lettuce, the features of treated samples were compared with appropriate for the control plant, grown in the same conditions of light, temperature and humidity, but without the addition of nanomaterial. The physiological growth parameters, quantity of pigments (chlorophyll a, chlorophyll b, and carotenoids) and total polyphenols, as well as the antioxidant activity and elemental content in lettuce leaves was determined.

The study found that the amount of bioactive compounds varied in the treated plants compared to the control ones, depending on the type of nanomaterial. The same variation was observed in the case of antioxidant capacity. The use of CNTs functionalized with metal oxides increased the levels of wide number of elements in lettuce leaves. On the contrary, metal oxide nanoparticles and CNT functionalized with carboxyl groups induced decrease in content for more elements than increase. Soil amending with MnO<sub>2</sub> affects the content of more than ten elements in leaves of lettuce. Simultaneous application of CNT with MnO<sub>2</sub> and Fe<sub>3</sub>O<sub>4</sub> may stimulate the elemental translocation of all elements from root to leaf.