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Residual acidified biochar modulates growth, physiological responses, and water relations of maize (Zea mays) under heavy metal–contaminated irrigation water. Environmental Science and Pollution Research (2020) 27:22956–22966

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Abstract

A field trial was carried out to examine the influence of residual acidified biochar (a 3:100 (w/w) mixture of citric acid and citrus wood biochar) on soil properties, growth, water status, photosynthetic efficiency, metal accumulation, nutrition status, yield, and irrigation use efficiency (IUE) of maize grown under salty soil and metal-contaminated irrigation water. The acidified biochar (ABC) was applied to faba bean in 2016/2017 in saline soil (electrical conductivity (ECe) 7.6 dS m^{-1}) with three levels 0, 5, and 10 t ha^{-1} with 4 replications. The results summarized that after a year of utilization, acidified biochar still significantly affected the growth and yield by improved soil properties and decreased maize uptake of sodium by transient sodium (Na^{+}) binding because of its high adsorption capacity. Growth, physiology, and maize yields were influenced positively by ABC application, under metal-contaminated irrigation water. It was summarized that the utilization of ABC had a significant residual ($P \leq 0.05$) effect on reducing nickle (Ni), lead (Pb), cadmium (Cd), and chromium (Cr) accumulation in maize under heavy metal–contaminated irrigation water. However, more detailed open-field experiments should be carried out to assess the long-term residual impacts of ABC for sustaining maize production under biotic stress.

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