Effect of cow manure biochar on heavy metals uptake and translocation by zucchini (Cucurbita pepo L)

Mamdouh A. Eissa

Abstract:

Little is known about the efficiency of biochar in the safety of food production in arid and semiarid contaminated soils. A field experiment in the semiarid region of Upper Egypt was conducted to explore heavy metals uptake by zucchini (Cucurbita pepo L) plants as affected by the application of cow manure biochar (CMB). Three rates of CMB were added, i.e., 0, 4, and 8 tonnes ha\(^{-1}\). The roots and shoots of zucchini plants stored 75 and 78% of Zn and Cu, respectively, while 25 and 22% were transported to the edible portions. On the other hand, the roots and shoots of zucchini plants stored more than 99% of Pb and Cd, while less than 1% was transported to the edible portions. Cow manure biochar (CMB) minimized the values of bioaccumulation factor (BAC) for Zn, Cd, and Ni by 5.6, 21.9, and 27.9%, respectively, while these reductions in the case of translocation factor (TF) were 4.9, 7.5, 23, and 5.9%. Cow manure biochar at a rate of 4 tonnes ha\(^{-1}\) reduced the availability of Zn, Cu, Pb, Cd, and Ni by 13.3, 8.3, 13.8, 9.1, and 3.6%, respectively, compared to the control treatment. Cow manure biochar at a rate of 8 tonnes minimized Zn, Cu, Pb, Cd, and Ni concentrations in the edible parts of zucchini plants by 10, 17, 66, 20, and 26%, respectively, in comparison with the untreated soil. Biochar reduced the heavy metals bioavailability, moreover; biochar minimized the soil-root transfer and the rootshoot of toxic metals. It is recommended to add cow manure biochar to zucchini plants to reduce the accumulating of hazard metals in the edible tissues.

Keywords:

Contaminated soils . Safe limits . Human consumption . Heavy metals

Published In:

Arabian Journal of Geosciences , NULL , NULL