

Concentrations of Cu and Zn in tropical soil amended with sewage sludge

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Sewage sludge may be used as an agricultural fertilizer, but it may contain heavy metals and pathogens. The aim of this study was to obtain total and pseudo-total contents of Cu and Zn in samples from a Typic Eutrorthox amended with sewage sludge for 13 consecutive years in Jaboticabal (21°15'22"S 48°15'18"W, 618 m a.s.l), São Paulo state, Brazil. The bioavailable concentrations of these elements to maize were also determined. The experiment was installed during the 1997-1998 agricultural year, consisting of 60-m² plots in randomized blocks, with three treatments (rates of sewage sludge) and five replicates. The original treatments were: control (no sludge applied), 2.5, 5, and 10 t ha⁻¹ of sewage sludge (dry weight basis). The 5 t ha⁻¹ dose was established to provide the nitrogen (N) required by maize crops, under the assumption that 1/3 of the N in the waste would become available to plants during one year. The treatments were modified to include mineral fertilizer in the second year of the experiment, with the goal of complementing the NPK contents of the sludge. Starting in the fourth agricultural year the 2.5 t ha⁻¹ rate was modified to 20 t ha⁻¹ in order to cause heavy metal phytotoxicity in plants.

The modified rates were thus 5, 10, and 20 t ha⁻¹ of sewage sludge (dry weight basis), and the control. The sludge had a pH_{H₂O} of 5.8, water content of 81.3%, 246.7 of C, 20.3 of P, 24.8 of N, 2.4 of K, 1.0 of Na, 15.9 of Ca, and 4.2 g kg⁻¹ of Mg. Heavy metal content of the sludge extracted by EPA 3051 method was 5.1 of Cd, 19.6 of Co, 531.5 of Cr, 669.0 of Cu, 34,526.6 of Fe, 320.2 of Mn, 290.7 of Ni, 106.6 of Pb, and 1,398.5 mg kg⁻¹ of Zn. We combined 20 subsamples to create compound soil samples for two soil layers, at depths of 0-10 cm and 10-20 cm. Total Cu and Zn concentrations were extracted via microwave digestion following the EPA 3052 method, pseudototal concentrations following the EPA 3051 method and aqua regia, and biologically available concentrations were extracted using Mehlich-III. The metal concentrations extracted by aqua regia (AR) were more similar to those obtained by EPA3052 than to those obtained by EPA3051, and the strongest correlation was observed between pseudo(total) concentrations extracted by AR and EPA3052 and bioavailable concentrations obtained by Mehlich-III. Content of copper and zinc in soil increased in the 13th year of the experiment.

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