

Long-Term Disposal of Sewage Sludge in an Oxisol and Metals Availability

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ABSTRACT: Search for sustainable destination of sewage sludge is being sought by the scientific community over time. One of the most sustainable and lowest cost management is its use in agriculture. However, several factors must be evaluated to avoid the occurrence of negative environmental impacts. One such factor is the possibility of metals accumulation and their dynamics in the soil over successive waste applications.

We aimed to evaluate Cu, Zn, Mn and Fe availability in an Oxisol which received successive applications of industrial sewage sludge, which have stopped eight years ago. The experiment consisted in the application of five sewage sludge doses, calculated based on N recommendation for maize cultivation: control treatment (0N), N recommended dose for maize (1N), two- (2N), four- (4N), and eight times the recommendation (8N). Available metals were extracted by DTPA (pH 7.3) and were determined by inductively coupled plasma optical emission spectrometry (ICP-OES) in soil samples taken from different layers (0-20, 20-40 and 40-60 cm). Metals availability in the superficial layer increased linearly with sludge dose raise.

Concentration (mg dm^{-3}) ranges for the metals were: Fe=39 to 149; Mn= 1.6 to 3.6; Cu= 0.8 to 18.6; Zn= 3.6 to 52.6. In the 20-40 cm layer, Fe availability increased following a quadratic model, while the other metals had a linear increase. In this case, concentration (mg dm^{-3}) ranges for the metals were: Fe = 41.3 to 125; Mn = 1.7 to 2.3; Cu = 0.9 to 10.8; Zn = 2.8 to 33.1. Mn availability did not increase in the 40-60cm layer and its concentration average was 1.25 mg dm^{-3} . The other metals had a linear increase, and their concentration ranges (mg dm^{-3}) were: Fe= 30 to 105.7; Cu= 0.6 to 2.53; Zn= 2.8 to 14.4.

The increasing dose of sewage sludge raised metals availability in the layers up to 40 cm. Zinc was the element that had a most significant increase in all layers. These results show that metals availability could be an environmental problem after discontinuing the applications of industrial sludge: therefore it should be better studied and monitored.