



## Nickel in an Oxisol treated with sewage sludge and cropped with maize in a field long term study

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Ni is a heavy metal already considered a plant nutrient, because it is a component of urease, but in high concentrations it can be toxic to plants. Sewage sludge produced by the wastewater treatment of SABESP (Companhia de Saneamento Básico do Estado de São Paulo) located in Barueri, SP, Brazil, which treats the wastewater from the metropolitan region of São Paulo, may contain high contents of Ni. As Ni availability to plants depends on the form in which it occurs in the soil, the purpose of this work was to evaluate the effect of rates of biosolid on the soil Ni and the uptake of the metal by maize plants.

The experiment was carried out under field conditions during 5 years in Jaboticabal, SP, Brazil, using an experimental design of randomized blocks with 4 treatments and 5 replications. The treatments consisted of 4 rates of biosolid: 0.0 (control with no fertilization in the first year and mineral fertilization in the following years), 2.5 (2.5 Mg ha<sup>-1</sup> biosolid during the first 3 years and 20.0 Mg ha<sup>-1</sup> in the following two years), 5.0 and 10.0 Mg ha<sup>-1</sup> biosolid, dry basis. Maize (*Zea mays*, L.) was the test plant and the soil was an Oxisol, which chemical properties in samples obtained before the sowing in the fifth growing season were pH (CaCl<sub>2</sub>)=5.0, P<sub>resin</sub>= 65 mg dm<sup>-3</sup>, Organic Matter= 31 g dm<sup>-3</sup>, K= 4.7, Ca= 40, Mg=19 mmol<sub>c</sub> dm<sup>-3</sup>, H+Al= 48 mmol<sub>c</sub> dm<sup>-3</sup>, CEC 111,2 mmol<sub>c</sub> dm<sup>-3</sup>. Biosolid was obtained from the wastewater treatment plant of SABESP located in Barueri, metropolitan region of São Paulo, Brazil, and presented the following chemical composition: N<sub>Kjeldahl</sub>=40.87, P= 19.49, K= 0.85, S= 14.62, Ca= 30.60, Mg= 3.77, (in g kg<sup>-1</sup>, dry basis), Cu= 689.61, Fe= 25471.90, Mn= 193.87, Mo= 10.07, Ni= 297.00 and Zn= 2929.84 (in mg kg<sup>-1</sup>, dry basis). The experiment started in the growing season of 1997/1998, when it was made a liming to

bring the V% to 70%, and is being repeated till now using the same plots. Soil samples were collected 60 days after sowing in the depths. 0-20 and 30-40 cm, air dried and analyzed for total Ni and for the content of Ni in the fractions humin, fulvic acid and humic acid of the soil organic matter. Soil organic matter was extracted with 0.1 mol L<sup>-1</sup> NaOH and the fractions fulvic and humic acid were obtained by acidifying the alkaline extract. Humin was the fraction not extracted by the alkali.

Soil total Ni was affected by the sewage rates only in the depth 0-20 cm, just the layer where the residue was applied and only for the higher rates. This means that the metal did not move in a significant way from the upper to the downer layers.

Nickel concentrated in the fraction humin, which was followed by the fractions fulvic and humic acid. This explains why the movement of Ni down in the soil profile was very short.

Ni added to the soil through sewage sludge concentrated in the humin fraction and moved only a little bit down in the soil profile. The application of till 50 Mg ha<sup>-1</sup> of sewage sludge parceled in 5 years did not affect the concentration of the metal in maize tissue. Ni concentration in the fulvic acid fraction correlated to the uptake of the metal by maize plants.