Effects of external copper (Cu) loading and liming on the availability and fractionation of Cu in soils

Bakshi, S.[1], He, Z.L.[1], Harris, W.G.[2]

[1] IFAS, Indian River Research and Education Center, University of Florida, Fort Pierce, FL 34945.

[2]Soil and Water Science Department, University of Florida, Gainesville, FL 32611

Copper (Cu) is an essential micronutrient for human and animal health, but toxic at excessive levels. Copper compounds are widely used in agriculture and horticulture as fertilizers and/or fungicides. In this study, laboratory incubation and analyses were conducted to examine the effects of external Cu loading on forms and bioavailability of Cu in soils. Surface samples (0-20 cm) were collected from two South Florida citrus groves mapped as an Alfisol and a Spodosol, common soils under citrus production in the region. Samples were treated with external Cu at levels of 0, 200, 600, and 1000 mg kg^{-1}, and incubated at room temperature for 12 months before subsamples were analyzed for available Cu by $CaCl_2$, NH_4OAc, and Mehlich 3 extraction methods and fractionation of Cu. External Cu loading generally decreased soil pH, particularly for the Spodosol, thus enhancing Cu availability and movement. Liming affected Cu availability and mobility. An increase in soil pH decreased available Cu in soils as estimated by the different extraction procedures. Soil Cu fractionation data revealed that most increases in soil Cu occurred in the exchangeable and oxides-bound fractions, which are positively related to external Cu loading rate and correlated with available Cu. Liming tended to convert Cu from available pools (exchangeable, organic-bound) to more stable forms (oxides-bound and residual fraction). These results indicate that most Cu accumulated in the citrus grove soils is highly mobile and bioavailable, and thus may have potential impacts on citrus production and the environment.