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## Copper nanoparticles or compounds impact agronomic and physiological parameters in cilantro (*Coriandrum sativum*)

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In this study, copper-based nanoparticle (NP) or compounds are investigated for their potential harm to the environment, using cilantro as the model species. Cilantro plants were exposed to  $\text{Cu}(\text{OH})_2$ , nanosized copper (nCu), microsized copper (uCu), nanosized copper oxide (nCuO), microsized copper oxide (uCuO), and  $\text{CuCl}_2$  at 20 and 80 mg/kg soil. After 30 days exposure, plant size, Cu accumulation, and chlorophyll content were measured by a ruler, inductively coupled plasma-optical emission spectroscopy (ICP-OES), and SPAD chlorophyll meter, respectively. Results showed no effects on root length, but shoot elongation decreased by 12.4% on plants exposed to 80 mg/kg nCu and by 11 % in plants exposed to uCuO at 20 and 80 mg/kg. ICP-OES results showed a reduction trend in root copper of all treatments, even though no statistically significant differences were evident compared to control; while the amount of copper in shoots was significantly higher for all treatments, compared to control. Chlorophyll content decreased significantly on plants exposed to 20 mg/kg uCuO, but increased on plants exposed to  $\text{Cu}(\text{OH})_2$ , nCu, and uCuO at 80 mg/kg. Overall, uCuO showed higher toxicity to cilantro, compared to nanoparticulate copper.

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