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Can quinoa, a salt-tolerant Andean crop species, be used for phytoremediation of chromium-polluted soil?

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Quinoa (Chenopodium quinoa Willd), an ancient Andean halophytic seed crop, exhibits exceptional resistance to salinity, drought, and cold. Consistent with the notion that such a resilient plant is likely to tolerate toxic levels of heavy metals as well and could, therefore, be employed for the clean-up of polluted soil (via phytoextraction or phytostabilization), the species' ability to take up, translocate, and tolerate chromium (CrIII) was investigated in a greenhouse pot experiment. A cultivar adapted to European conditions (cv. Titicaca) was grown on soil spiked with 500 mg kg-1 DW of $Cr(NO_3)3•9H_2O$, combined (or not) with 150 mM NaCl, or on soil grown with 150 mM NaCl alone. Plants were grown up to maturity (four months after sowing), and then plant biomass and concentrations of Na, Cr, and other elements (e.g., Fe and P) were evaluated in the plant organs. Soil Cr content (total and available fractions) was analysed at the start of the experiment, one week after the last addition of Cr and/or NaCl, and at the end of the trial. No visible toxic effects were observed under the different culture conditions. Results revealed that Cr was mainly accumulated in roots, while Na+ was translocated to the aerial parts. In order to compare plant stress responses under the different treatments (Cr, NaCl, Cr+NaCl), expression levels of several stress-related genes, together with those of a potential Cr transporter, were determined by quantitative real-time RT-PCR.