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Arsenic in Hawaii Soils

Past applications of arsenical pesticides might have resulted in elevated levels of arsenic (As) in surface soils of many former sugarcane lands in Hawaii. This hypothesis was tested by measuring total As in 22 Hawaii soils, representing 4 soil orders: Andisols (mainly on the island of Hawaii), Oxisols and Ultisols (Kauai, Maui, and Oahu Islands), and Inceptisols (Kauai, lowland areas). Total As averages 50 ± 10 mg/Kg, which is more than double the maximum As concentration of 22 mg/Kg, accepted by the state, for uncontaminated soils. Perhaps as a result, some streams on Oahu have as much as 80 µg As/L in their water. Next, an Andisol containing approximately 450 mg As/Kg was used for chemical evaluations: (a) Adding phosphate (HPO42-) released more As into the soil solution, (b) Adding colloidal Fe(OH)3 decreased bioaccessible As, (c) Bioaccessible As, defined as the fraction of As extracted with dilute HCl (pH 1.5, at 37 oC) was only 10% of total As, and (d) Mehlich-3 extractable As was similar to and closely correlated with bioaccessible As (using a set of 6 soil samples). To further address the As problems in Hawaii soils, a phytoremediation trial with brake fern (Pteris vittata) is being conducted on a “brown” field (an Oxisol) in Kauai, where the total As was 40 – 60 mg/Kg. Preliminary results showed that the ferns could take up considerable amounts of As: Their leaf tissues contained 800 - 1000 µg As/g as compared with 2 – 5 µg As/g in nearby vegetation.

Author: Nguyen Hue
University Affliation: University of Hawaii
Co-Author(s): William Cutler