

Research Project: [Plant Variation in Cd, Pb, Zn and As Accumulation and Bioavailability and Methods to Limit Risk](#)

Location: [Environmental Management and Byproduct Utilization Laboratory](#)

Title: Effect of flooding lead-arsenate contaminated orchard soil on growth, arsenic and lead accumulation in rice

Author

- [Codling, Eton](#)

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Interpretive Summary: Lead and arsenic have been used as pesticides and defoliant in orchards and cotton production. There is concern that if these contaminated soils are used for rice production under flooded conditions, lead and arsenic could accumulate in plant and in turn become a health risk when consumed by humans. The objective of this study was to determine the effects of flooding of lead-arsenate contaminated orchard soils on rice grain yield and arsenic and lead accumulation. Two orchard soils, Bagstown and Chashmont, with total lead concentrations of 676 and 961 mg kg⁻¹ and arsenic concentrations of 133 and 291 mg kg⁻¹, respectively, were planted with rice and grown for 165 days in the greenhouse under flooded and non-flooded conditions. Flooding reduced grain yield and increased grain As concentration on both soils. Grain Pb decreased with flooding in the Bagstown soil but increased for the Chashmont soil. Arsenic and lead concentrations in the husk and straw were higher than in the grain. The low grain As and Pb levels observed would not be expected to become a human health risk through consumption of this rice. The higher As and Pb in the husk and straw could become a health risk if these materials are fed to livestock or used for bedding.

Technical Abstract: Lead and arsenic have been used as pesticides and defoliant in orchards and cotton production. There is concern that if these contaminated soils are used for rice production under flooded conditions, lead and arsenic could accumulate in plant and in turn become a health risk when consumed by humans. The objective of this study was to determine the effects of flooding of lead-arsenate contaminated orchard soils on rice grain yield and arsenic and lead accumulation. Two orchard soils, Bagstown and Chashmont, with total lead concentrations of 676 and 961 mg kg⁻¹ and arsenic concentrations of 133 and 291 mg kg⁻¹, respectively, were planted with rice and grown for 165 days in the greenhouse under flooded and non-flooded conditions. Flooding reduced grain yield and increased grain As concentration on both soils. Grain arsenic increased from 0.22 ± 0.02 for the non-flooded to 0.28 ± 0.01 mg kg⁻¹ for the flooded Bagstown soil and from 0.28 ± 0.03 non-flooded to 0.84 ± 1.03 mg kg⁻¹ for the flooded Chashmont soil. Grain Pb decreased with flooding in the Bagstown soil but increased for the Chashmont soil. Arsenic and lead concentrations in the husk and straw were higher than in the grain. The low grain As and Pb levels observed would not be expected to become a human health risk through consumption of this rice. However, bioavailability studies are needed to determine the bioavailability of As and Pb in the grains. The higher As and Pb in the husk and straw may indirectly become a human health risk because rice straw is used for livestock feed and bedding.

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