

Arsenic contents and physicochemical properties of agricultural soils from the Red River Delta, Vietnam

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Abstract: To evaluate arsenic (As) levels in agricultural soils of the Red River Delta in northern Vietnam, surface (0-5 cm) and subsurface (20-25 cm) soil samples were collected from 18 paddy and six upland fields on both sides of the river. As a reference, forest soils were also sampled at two sites of the upper river basin. The total As contents of approximately 80% of the surface paddy and upland soils exceeded the maximum allowable limit for Vietnamese agricultural soils (12 mg kg^{-1}). Arsenic contents higher than 35 mg kg^{-1} were found in soils from the Hungyen and Hanam provinces, where high As levels in the groundwater have also been reported. Sequential fractionation of As in these soils indicated that the amounts of As in the phosphate-extractable and residual fractions were higher than those in the forest soils. Elevated total As contents were also detected in the surface soil of a paddy field near a fertilizer factory in Hanoi (site P10). The amount of HCl-extractable As in the surface soil at P10 corresponded to 84% of the total As, while the proportion never exceeded 40% at other locations. In the surface soil at P10, most of the As was part of the phosphate-extractable fraction. Significant correlations between the total As contents of the upland soils and their non-crystalline Fe oxide contents ($r = 0.652$, $P \leq 0.05$) and between As levels of paddy soils and their crystalline Fe oxide contents ($r = 0.544$, $P \leq 0.01$) were observed. Overall, the present study indicated that although serious As pollution was not found in the studied area, there were some point pollutions caused by industrial activities, in addition to some non-point pollutions resulting from high As concentrations in the groundwater. In addition, Fe oxides in the soils are important factors affecting the As contents of agricultural soils in the Red River Delta. © 2008 Japanese Society of Soil Science and Plant Nutrition.

Author Keywords: Arsenic; Pollution; Red River Delta; Soil; Vietnam

Year: 2008

Source title: Soil Science and Plant Nutrition

Volume: 54

Issue: 6

Page : 846-855

Cited by: 2

Link: [Scopus Link](#)

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ISSN: 380768

CODEN: SSPNA

DOI: 10.1111/j.1747-0765.2008.00312.x

Language of Original Document: English

Abbreviated Source Title: Soil Science and Plant Nutrition

Document Type: Article

Source: Scopus

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