VERTICAL DISTRIBUTION OF SOIL ARSENIC AND SOME SELECTED PROPERTIES IN A RICE FIELD IRRIGATED WITH As-CONTAMINATED WATER

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INTRODUCTION

Most of the shallow groundwater is heavily contaminated with arsenic in Bangladesh. Groundwater is used extensively in irrigation of rice, suspected to contaminate soil and may enter to the food crops. Study on the behaviour and mobility of As in rice soil is now a major concern. Soil pH, redox potential, contents of oxides and hydroxides of iron and manganese, clay and soil organic matter (SOM) are some of the important factors affecting the mobility and adsorption of As (Smedely and Kinnburgh, 2002). This study was conducted to determine the vertical distribution of soil As and the mentioned properties in different soil depths in an irrigated rice field.

METHODOLOGY

The experiment was conducted in Tala thana of Satkhira district in the south-western region of Bangladesh. Sampling was done in a rice field irrigated with As-contaminated groundwater (250 µg As/l). Soil samples (0-15, 15-30, 30-45 and 45-60 cm depths) were collected from 22 different spots of the experimental field. Samples were analysed for pH, SOM, clay contents, total and acidified oxalate extractable As (Fe-bound As), Fe and Mn. Arsenic content was determined using AAS with hydride generation system.

RESULTS AND DISCUSSION

The soil was moderately alkaline in reaction. Soil organic matter content in the top soil was higher and decreased with increasing soil depth, while total Fe and Mn content increased gradually from top soil to the lower layer (Table 1).

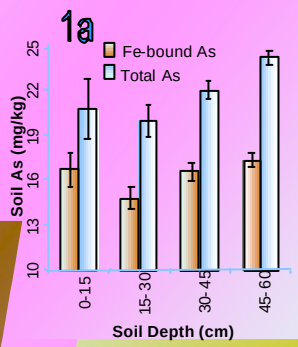
Table 1. Some soil properties of different depths at the experimental site.

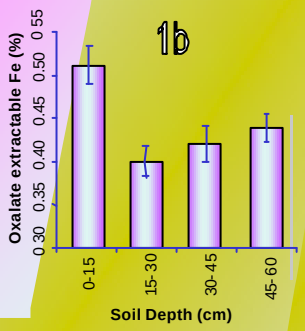
Depth (cm)	pH	SOM (%)	Total Fe (%)	Total Mn (mg/kg)
0-15	8.10	2.08	4.01	534
15-30	8.15	1.25	4.23	537
30-45	8.14	1.12	4.28	550
45-60	8.14	1.14	4.33	539

Soil As content was higher in the top soil, decreased in the sub surface soil and increased again with increasing depth (Fig. 1a). The higher level of SOM in the top soil and the dissolution of As from the Fe oxides and hydroxides may increase the top soil As content (Smedley and Kinniburgh, 2002 and Takahashi et al. 2004). Irrigation with high As content water may also contribute to increase the As concentration in top soil.

The vertical distribution pattern of Fe-bound As was similar to that of total soil As (Fig. 1a). An average of 76% of total soil As was found in Fe-bound form.

The similarity in the vertical distribution of soil As to oxalate-Fe and clay contents (Fig. 1b and c) suggests that the mobility of As in soil is closely related to these properties. Higher adsorption of As in soils with high clay content was reported by Huq et al. (2003). Takahashi et al. (2004) reported that As is principally hosted by Fe and Mn hydroxides.





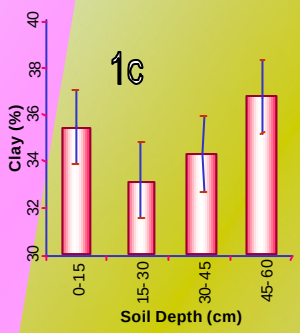


Fig. 1. Depth wise distribution of 1a) total and Fe-bound As, 1b) oxalate extractable Fe and 1c) clay content of the experimental soil (error bars indicate ±SE).

CONCLUSION

Under reduced and high pH conditions, soil As content varied with depth and can be leached from surface to the deeper layers. The variability was closely related to the clay and oxalate extractable iron content of the soil.

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