

Arsenic Distribution in Soil-Water-Plant Linking Agro-Ecology of Brahmanbaria, Bangladesh

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INTRODUCTION

Arsenic (As) contamination in ground water is a severe problem in Bangladesh. The source of As contamination is thought to be geological (BGS report, 1999). Immediate concern of As contaminated drinking water, As contaminated ground water used for irrigation purpose to mainly rice field may increase the detrimental effect on health, food quality and a long-term harmful effect on soil and agriculture. Previous research, in fact, showed that long-term use of As contaminated ground water to irrigate crops, particularly rice, has resulted in elevated soil As levels in Bangladesh (Abedin, 2002) and therefore, there is concern about accumulation of As in rice.

MATERIAL AND METHODS

An investigation was conducted to study the water quality of 110 shallow tube wells (STWs) and soil quality of corresponding 110 irrigated soils during March, 2002 in Meghna Estuarine Floodplain Soils at Brahmanbaria. Rice straw grown in those irrigated areas were also analyzed. Water samples were collected from the running STWs in containers previously containing dilute HCl. Soil samples (0-15 cm depth) were collected from a distance of 15m towards the direction of running water. Soil and plant samples were digested in tri-acid mixture and the extracts and water samples were analyzed by Hydride generator-AAS after reduction of As(V) to As(III) with KI and ascorbic acid. Water samples were also analyzed for pH, Zn, Mn, Fe, P, Ca, Mg, Na and K and soil samples for pH, OM, P, S, B, Ca, Mg, K, Mn, Fe, Cu and Zn using Hunter's (1980) method. Depth and duration of usages of STWs ranged from 21 to 76 m and 1 to 18 years, respectively.

RESULT AND DISCUSSION

Arsenic levels in water samples ranged from 4.11 to 661.58 ppb (Fig. 1) of which 52 samples (47.3 %) exceeded maximum irrigation water permissible limit (100 ppb) and 74 samples (67.3 %) exceeded WHO's maximum drinking water permissible limit (50 ppb). In maximum cases water As content decreased with the increase of boring depth of STWs. Correlation between water-As and other water parameters like pH, Zn, Mn, Fe, P, Ca, Na and K were not significant, except for water-Mg ($r=0.79$).

Arsenic levels in soil samples ranged between 1.03 and 38.6 ppm. Out of 110 soil samples only about 6 % was above 20 ppm. Correlation between soil As and soil parameters like pH, OM, P, S, B, Ca, Mg, K, Mn, Fe, Cu and Zn were not found significant.

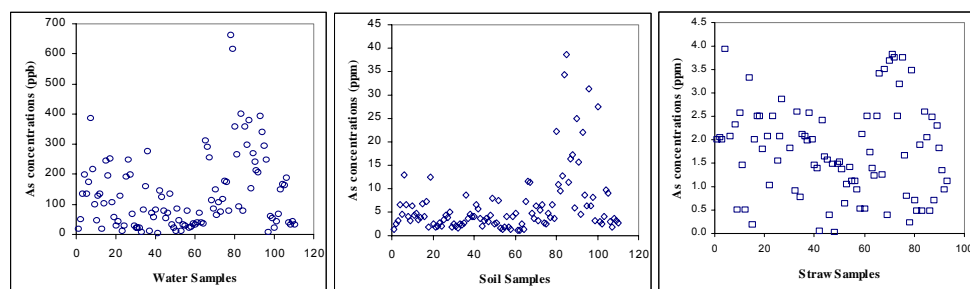


Fig. 1. Arsenic concentrations in water, soil and rice straw samples collected from Brahmanbaria region.

Correlation coefficient between soil As and acid oxalate extractable Fe was 0.58. Arsenic content of the analyzed rice straw samples ranged between 0.034 and 3.93 ppm. The correlation coefficient between water-soil, water-straw, and soil-straw As were 0.60, 0.41 and 0.29, respectively. The results obtained from the analytical work done so far indicate that the As concentrations of the study area at Brahmanbaria (Agro Ecological Zone 19) of Bangladesh exceeded the WHO's permissible limits in many cases.

REFERENCES

- Abedin, J. (2002) Arsenic uptake, metabolism and toxicity in paddy rice (*Oryza sativa* L). Unpublished PhD Thesis. Department of Plant and Soil Science, University of Aberdeen, UK.
- BGS (1996) Groundwater studies for arsenic contamination of Bangladesh. Main report and supplemental volumes 1-3, Geological Survey, Ministry of Local Government, Rural Development and Cooperatives, Department of Public Health Engineering, Dhaka, Bangladesh and Mott MacDonald International Ltd, UK.
- Hunter, A.H. (1980) "Soil Fertility Analytical Service in Bangladesh" consultancy report, BARI project Phase II, BARC, Dhaka, Bangladesh.