

# Movement of Arsenic in Irrigated Rice Soil

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## INTRODUCTION

Arsenic (As) in groundwater and its transport in the environment appear to be a great concern in Bangladesh. This element contamination poses a serious threat to man and agriculture sustainability in this country. Besides domestic use, significant quantities of water from shallow aquifers are being used in the dry season particularly for irrigating Boro rice. Arsenic is coming out and accumulating in soils. Long term use of As contaminated irrigation water from shallow tube wells (STW) may result in elevated As concentration in soils and plants and may also lead to yield loss.

## METHODS

The experiment was conducted in a net house of Bangladesh Agricultural University (BAU) Mymensingh during January to April 2004. High arsenic containing soils were collected from the Faridpur district and low As soils from the BAU farm, Mymensingh. Twelve (4 soils x 3 treatments) undisturbed soil cores (30 cm diameter by 40 cm length) were collected in PVC pipes. Three As treatments (irrigation water having 0, 1 and 2 ppm As) were applied to the soil cores. Whatman filter papers, glasswool and a layer of acid washed silica sand sieved to 1-2 cm were placed at the bottom of the perforated plastic containers where soil cores were placed. Two holes of the plastic container were connected with a nitrogen gas pre-filled air-tight conical flask by two plastic pipes via glass T tube. Boro rice (cv. BRRI dhan 29) seedlings were transplanted into the ring and treatment-wise As contaminated irrigation water was applied to the soils. The leachate samples were collected periodically from soil cores (with and without plants) and analysed for pH, arsenate, arsenite (by AAS- HG Method), available P, Fe and Mn contents. Initial soils from the pit of the cores at 5 cm intervals up to 40 cm depth were analysed.

## RESULTS AND DISCUSSION

The average As concentration in leachate was very low in all soils irrespective of the level of As applied through irrigation water. However, the soils irrigated with higher As showed higher As concentration in the leachate. Concentration of As in the leachate increased with time from the day after transplantation of rice (Fig.1). Arsenic(III) was the dominant As species, comprising on average 76% of the total As. In soil core BAU-1, the mean concentration of As in the leachate samples of As<sub>0</sub>, As<sub>1.0 ppm</sub>, and As<sub>2.0 ppm</sub> treatments were 24.2, 39.5, and 47.8 µg/L respectively where 0, 43.5 and 86 mg As were applied to the soils through irrigation water. Total amount of As in the leachate were 168, 277 and 328 µg where the total volume of leachates obtained were 6.8L, 6.9L and 6.7L, respectively. Like BAU-1 soil, similar mean concentrations of As in the leachate were obtained in BAU-2 and Faridpur-

2 soils, but total leached As was lower in both soils, due to a lower volume of total leachate. In Faridpur-1 soil the mean concentration of As in the leachate were 32.5, 48.1 and 67.7  $\mu\text{g/L}$  and total leached As were 155, 229 and 326  $\mu\text{g}$  where 0, 40.5 and 82 mg As were added. The background As of the Faridpur-1 soil was higher than the other soils.

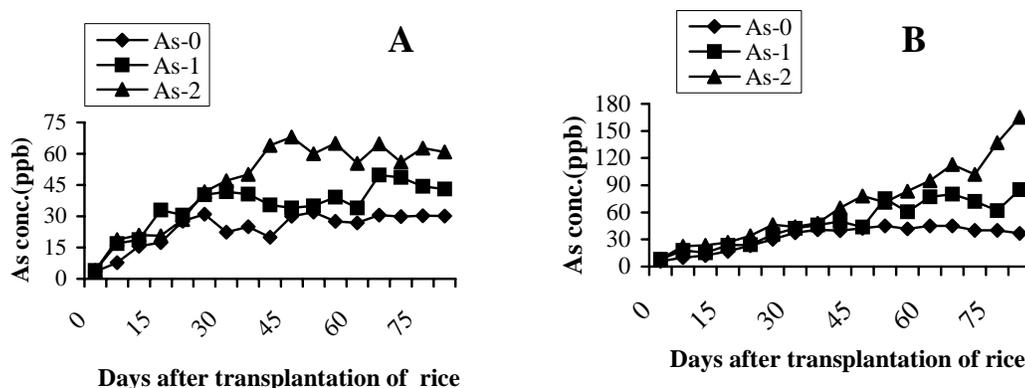


Fig. 1. Arsenic concentration in the leachate with time in BAU-2 (A) and Faridpur-1 (B) soils

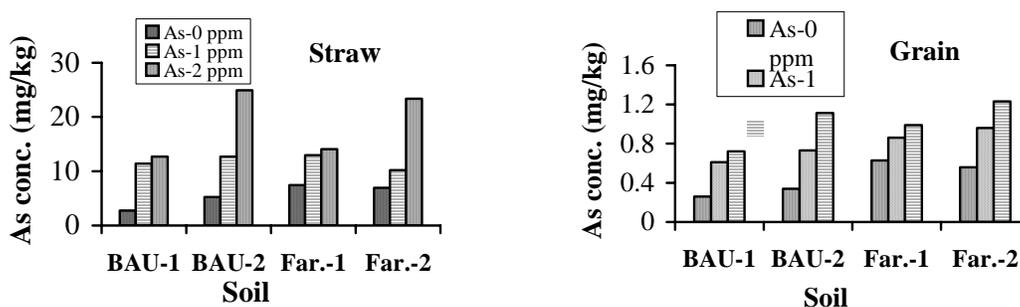


Fig. 2. Arsenic concentration in rice grain and straw.

The leachate samples concentration of As in without rice cultivated cores was lower than that of the rice cultivated cores. The As leaching in soil is positively related to the rate of As application and to the volume of water that percolates through the soil profile. Average pH in the leachate was around 6.0- 6.5. A significant positive correlation was observed between As with Fe and P concentration and significant negative correlation was found between Mn and As concentration in the leachate.

Rice yield decreased with increasing As concentration in irrigation water. Arsenic concentrations in rice straw, husk and grain increased with increasing arsenate concentration in irrigation water (Fig. 2). The concentration of As distributed in rice grain ranged from 0.26 - 1.23 mg/kg, in rice husk 1.0 - 2.72 mg/kg and in rice straw 2.74 - 24.9 mg/kg.

## CONCLUSION

The amount of As in the leachate was very low in comparison to As added with the irrigation. The As concentration increased in rice grain, straw and husk for application of As contaminated water.

## ACKNOWLEDGEMENT

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