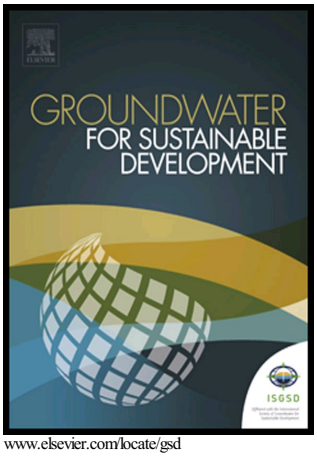

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Spatial variability and competing dynamics of arsenic, selenium, iron and bioavailable phosphate from ground water and soil to paddy plant parts

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Abstract

Groundwater contamination by geogenic arsenic in the Bengal delta has promoted this element as a prime environmental contaminant. Evoked by the risk of arsenic in the food chain, study of the source, cropland soil and irrigation water has grown the interest of studying the arsenic dynamics in the agro-ecosystem. As the arsenic has synergistic and antagonistic relationship with some elements, their presence in the system, influence arsenic dynamics or vice-versa. The element dynamics from the source, i.e. irrigated groundwater and soil, to paddy plant parts was enumerated in spatial scale, i.e. in highly endemic and non-endemic agro-fields. Element translocation from the combined source, separately from groundwater and soil was considered. One unit increase of the arsenic concentration in soil and irrigated water results average 3.660 fold and 1.345 fold increase of the arsenic concentration in paddy plants respectively. However, the available phosphate concentration in the paddy plant was not significantly related to the bioavailable phosphate concentration of soil and irrigated water. The selenium concentration in paddy plants was significantly related to selenium present in soil ($p<0.01$) and showed 0.678 fold increase into the paddy plant with a unit change in soil. The iron concentration in the paddy plant was related to iron concentration in irrigated water ($p<0.01$) and showed 0.365 fold increment. Within the paddy plant, arsenic and selenium compete during upward translocation. Rice husk (mainly used as fodder) and roots retain the maximum amount of elements, of which some are pollutants like arsenic, so naturally save the food chain.

Graphical abstract

Graphical presentation of the element translocation from the soil and irrigated water to the paddy plant parts. Arrows indicate translocation route. Arrow size are according to the Weight Average of the of Canonical Correlation analysis for element dynamics and or interrelationship estimation as depicted in the texts. The prefix (A) stands for Bioavailable.