

Reducing Arsenic Accumulation in Rice Grains using Phytoremediation: A Greenhouse Study

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Arsenic (As) is a Class I human carcinogen associated with various diseases including diabetes, obesity, and cancer. The soil and groundwater in South Asia, especially West Bengal in India, and Bangladesh are naturally contaminated with As. In many areas, contaminated groundwater is the only source for irrigation, drinking, and other household uses. Extensive use of As contaminated groundwater for irrigation has led to an increase in As in soil, and subsequently in crops. Rice is a major part of the diet for more than three billion people around the world. In South Asia, rice is grown during the *aman* (summer) season followed by a fallow period of 3-4 months before the next growing season. The World Health Organization (WHO) has set advisory levels of As in white rice grains at 0.2 mg/kg. Most strategies for lowering As accumulation in rice so far are experimental and have limited applicability. Our objective was to test a more practical approach of using crop rotation, by planting an As hyperaccumulating fern, *Pteris vittata* (PV) during the fallow period to reduce the concentration of As in the soil, and consequently in rice grains. Soil samples were collected from agricultural fields in Nadia, West Bengal with an initial As concentration, 152±28 mg/kg. In the greenhouse, rice was grown in columns submerged in 4-6 inches of water maintained under temperatures between 23-26°C, 8-10 hours of daylight. Rice plants were rotated with PV for three months. Arsenic concentration in the soil, plants, and seeds was analyzed by ICP-OES after acid digestion. After two cycles of crop rotation, the As accumulation in rice grains and soil decreased significantly by 7.9% and 36.8% respectively. A follow-up pilot-scale testing of the crop rotation protocol under field conditions is necessary to demonstrate the effectiveness of this approach.

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