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Analysis of molecular role of transporters and nutrient utilization genes in rice during arsenic: Silicon exposure

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Arsenic (As) as non-essential and carcinogenic metalloid has become a major limiting factor for the production of crop plants. Rice (Oryza sativa L.) paddies contaminated by As is a staple crop over half the world population and its consumption creates severe health problems. Due to higher availability of As in anaerobic flooded soil, rice efficiently accumulates more As than other cereal crops. Therefore, selecting rice varieties tolerant to As stress or able to cope up As stress along with other metals is important for sustainable production of rice. Silicon (Si) attracted substantial attention because of its positive effect on plants during abiotic stress, including As stress. We here report that priming rice seeds with As and Si together, helped the plant to sustain for longer period. We examined Si induced tolerance in rice seedlings at short (7 d) and long (15 d) exposure periods under As(III) and Si treatments since their germinating stage. Results showed that the expression of OsLsi1, OsLsi2 and OsLsi6 transporters was more in As(III)+Si treatment as compared to control and Si treatment, but lower than As(III) alone treatment. Expression was maximum in shoot and root at 15 d over 7 d under both As(III) and As(III)+Si treatment, which ultimately leads to decreased accumulation of As in the presence of Si. Morphological characters and macro- micronutrient contents also improved with Si and differentially regulated 12 key genes (NR, NiR, AMT, NR, GS, GOGAT, PT, PHT1, PHT2, APase, KAT1 and HAK10) related with NPK transport and utilization. Results highlight that Si plays a decisive role in growth recovery of As-stressed rice.

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