Agro-Rhizoremediation: Rhizoremediation With Agro-Transformed Oryza sativa to Facilitate Arsenic Degradation in situ (Year III)

Bhat, Prisha (School: Plano East Senior High School)

Arsenic accumulation in rice is becoming increasingly problematic, threatening the health of over 150 million people globally. This project aims to use rhizoremediation with rice plants transformed with arsenic-resistant genes to facilitate the self-detoxification of arsenic. Raw sequences of 16s rRNA from 82 soil samples obtained from the National Center for Biotechnology Information were processed through Qiime2 to examine bacterial taxonomy in arsenic-contaminated and uncontaminated soil rhizospheres. Pseudomonas and Burkholderia genera constituted over 63% of the microbial community in contaminated rhizospheres. Rice cotyledons infected with transformed (acr3 and arsC arsenic-resistance genes) Agrobacterium tumefaciens were cultivated in plant tissue culture media to develop transgenic rice plants. The transformed rice plants were then grown in soil inoculated with P. putida contaminated with 25 ppm arsenic. Arsenic content in the soil, stems, and leaves were measured at various stages of plant growth. After four weeks, there was a 60% decline in soil arsenic from baseline. Arsenic content in transgenic stems was less than one ppm, compared to six ppm in non-transgenic plants, and was undetectable in the leaves in transgenic plants. Statistical significance was confirmed using three T-Tests. Spectrophotometric chlorophyll content analysis demonstrated that genetic transformation and arsenic decontamination did not negatively affect plant health. Results supported that genetically-modified rice plants were effective in arsenic self-detoxification. Therefore, Rhizoremediation using agro-transformed rice plants is a promising method for decontaminating polluted soil and lowering arsenic accumulation in rice grains.

Awards Won:
Second Award of $2,000
U.S. Agency for International Development: USAID Science for Development First Award - Agriculture and Food Security