Computational Analysis of the Rhizosphere Metagenome and a Wet Lab Approach To Derive an Optimal Strategy for Heavy Metal Remediation in situ

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The Environmental Protection Agency reports nearly half a million contaminated sites throughout the U.S. Rhizoremediation is a promising solution to this global public health concern, as current strategies are expensive and ineffective. Raw sequences of 16s rRNA from 96 soil samples obtained from the National Center for Biotechnology Information (NCBI) were processed through Qiime2 to examine bacterial taxonomy in contaminated and uncontaminated rhizospheres. Three different soil microbes - Pseudomonas fluorescens, Rhizobium leguminosarum, and Burkholderia vietnamiensis were inoculated in the rhizosphere of Brassica juncea, Oryza sativa, and Pisum sativum in soil contaminated with 500 ppm of lead. Soil lead content was measured at various stages of plant growth. After four weeks, soil lead content decreased from 500 to 150 ppm, a 70% decline in pots with P. fluorescens-B. juncea combination. Soil lead content decreased from 500 to 50 ppm in pots with P. fluorescens-R. leguminosarum-B. vietnamiensis triple combination with B. juncea, a 90% decline in soil lead content. Statistical significance was confirmed using a two-way ANOVA test. Chlorophyll content analysis of the dried leaves of plant groups using a spectrophotometer showed similar optical density to control leaves, indicating that lead decontamination in the soil did not negatively affect plant health. Therefore Rhizoremediation is an effective bioremediation strategy and can also significantly increase crop productivity by converting non-arable lands into arable lands.

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