A Third Year Study on the Bioremediation of Tetracycline Polluted Soils: How Antibiotic Resistance Can Reduce Antibiotic Pollution in the Environment and a Solution to Antibiotic Pollution-Related Crop Failure

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Antibiotic pollution in soils and groundwater is one of the world's most pressing problems. There are 1.4µg of antibiotics per-liter of freshwater and 125,000 tons of antibiotics polluted every year from humans and livestock usage. These antibiotics hinder crop growth, exacerbate antibiotic resistance, and pollute groundwater. However, no commercial treatments to degrade antibiotics in the environment exist. This project offers 1) a novel, natural approach to detoxifying antibiotic pollutants by utilizing antioxidants and bacterial enzymes produced by antibiotic resistant bacteria and 2) justification for implementing these solutions into the environment by testing them in vivo in wheat and corn. It was hypothesized that the ascorbic acid soil treatment would yield the greatest rate of crop growth. Antioxidants – ascorbic acid, beta carotene, and glutathione – and bacterial enzymes – chloramphenicol acetyltransferase, beta lactamase, and E.coli nitroreductase – were used as catalysts in bioremediating tetracycline (the most prevalent antibiotic pollutant) polluted soils, along with untreated tetracycline polluted soil as a control group. Antibiotic degradation and crop health were determined by crop height, rate-of-growth, and chlorophyll absorbance, as tetracycline inhibits protein synthesis and photosynthesis. The hypothesis was refuted: chloramphenicol acetyltransferase (4.98cm/4days) and E.coli nitroreductase (5.49cm/4days) had the highest growth rate for corn and wheat, respectively. All treatments yielded chlorophyll absorbance higher than that of the control. Data was statistically significant through ANOVAs. This project yields a promising solution for antibiotic pollution in the environment that is not only effective, but environmentally feasible and friendly.

Awards Won:

U.S. Agency for International Development: Third Award Agriculture and Food Security
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