Impact of Nanoplastic Contamination on Rhizosphere Microbiome and Plant Phenotype

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Abstract

Nanoplastic (NP) is an organic contaminant that is widespread in soil, water, and food. However, the effects of NP are not well understood, especially in the context of the rhizosphere-roots-microbiome interface and how they can impact both plants and the soil microbiome. Our hypothesis is that the presence of NP in the soil will lead to distinct changes in the root microbiome and result in a unique phenotype in the plant. To investigate this, we conducted an experiment in which two crops, tomato (*Solanum lycopersicum* cv. Micro-tom) and lettuce (*Lactuca sativa* L. cv Canasta), were planted in three different soil conditions: a control group with no NP (zero-NP) and two experimental groups with NP concentrations of 25 and 250 $mg.kg^{-1}$. The experiment took place over a 41-day period at Purdue's Ag Alumni Seed Phenotyping Facility. During this time, manual plant measurements and red-green-blue (RGB) and hyperspectral imaging were performed on 17 different dates. After the 41-day growth period, the plants were harvested and weighed, soil from pots and subject to various enzymatic assays to quantifying difference in elemental cycling potential, and DNA was extracted from both the bulk soil and the rhizosphere+roots. The 16S and ITS rRNA genes were then amplified and sequenced using the MiSeq Illumina technology and subject to various bioinformatic programs to quantify differences in composition and functional potential. This study aims to provide insights into how NP affects the rhizosphere, plants, and the associated microbiome, and the results may shed light on the environmental implications of NP contamination.

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