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Effects of Polypropylene Microplastics on Soil Microbiome and Growth of Corn (*Zea mays*) Plants

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Abstract

Microplastics (MPs) are small plastic particles less than 5 mm in size. The pollution of the environment with MPs is increasingly recognized as a new and emerging risk to biodiversity, ecosystem, human health, and well-being. Although it is known that soil ecosystems, particularly agricultural lands, are a significant sink for MPs, the implications of MPs on soil ecosystems still need to be extensively investigated. In general, MPs consider a negative influence on plant and soil microbial growth. The main objective of this study is to examine the impact of polypropylene MPs, on soil microbiota and development of the corn (*Zea mays*) plants. The present study involved the incorporation of soil with two distinct concentrations (20 mg/g and 40 mg/g) and three varying sizes (1mm, 2 mm and 2.8-5 mm) of polypropylene (PP) MPs, followed by preparing six MPs soil mixtures for investigation of soil microbiota, enzyme activities and development of the corn plants (*Zea mays*). MPs have negatively influenced shoot elongation (34.74%) and dry biomasses (67.61%). In addition, seed germination (28.57%-42.86%) was reduced in all the tested MPs mixtures in this study. MPs increased root lengths (82.63 %) and chlorophyll production (39.75%) relative to plants grown in MPs-free soil. Although bacterial growth has shown an increase (57.31%) along with urease activity, few MPs mixtures showed a reduced dehydrogenase activity (25.81%). In soil incorporated with 40 mg/g MPs, urease activity increased (10.55%) relative to the control, but bacterial growth reduced (57.31%). However, fungal growth significantly increased when the concentration of MPs increased from 20 mg/g to 40 mg/g on day-30. In this study, MPs showed size- and concentration-dependent influence on microbial growth and development of corn plants. Further, adding MPs influenced the soil's physical properties. An increased pH and decreased electrical conductivity and bulk density in soil. The present study concluded that polypropylene MPs have different impacts on plant development, microbial growth, enzyme activities, and physical parameters of soil, which can subsequently affect the functioning of the soil ecosystem.

***Keywords**:* Microplastics, Polypropylene, Soil microbiota, Corn plants, Soil physical properties