The Effects of Arbuscular Mycorrhizal Fungi and Mushroom Substrate on the Plant Growth and Soil Characteristics for PE Microplastics-Contaminated Soil

Choi, Jiwon (School: Fryeburg Academy)
Shin, May (School: Fryeburg Academy)

Microplastics (MPs) are a pervasive environmental contaminant that pose a threat to both terrestrial and marine ecosystems. Specifically, agricultural soils are widely exposed to MPs that can reduce soil physicochemical properties, nutrient cycling, and crop productivity. However, microorganisms like Arbuscular Mycorrhizal Fungi (AMF) and biodegradable materials like Mushroom substrate (MS) have been found to enhance plant growth and development even in disturbed soil. To assess the effectiveness of AMF and/or MS on plant growth and soil characteristics on the mitigation of MPs, an experiment was conducted using Allium fistulosum (Scallion) grown in two conditions: in the absence of MPs in the soil and in the presence of MPs in the soil. Each of the conditions had four different treatments, which is Control, AMF, MS, and AMF+MS. After three weeks of growth, AMF+MS treatment in microplastics soil showed the highest values in all categories: germination rate, plant height, root length, and growth rate ($p < 0.05$). Moreover, AMF treatment had the highest growth rate in the absence of microplastics ($p < 0.05$). To confirm the AMF colonization in the root samples, Trypan Blue staining method was used for light microscopic images. The samples demonstrated the potential fungi colonization in AMF treatment in the absence of MPs and in AMF+MS treatment in the presence of MPs, which correlates to the findings from statistical analysis. Overall, this study reveals that the use of AMF and/or MS together can alleviate the adverse impact of microplastics on the global ecosystem.

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