Tropentag, September 14-16, 2022, hybrid conference

"Can agroecological farming feed the world?
Farmers' and academia's views"

Interactive effect of biochar and PVC microplastic on soil microbes and enzyme activity

Attia Rubab Khalid[1], Tariq Shah[2], Ghulam Haider[3]

[1] *National University of Sciences and Technology (NUST), Islamabad, Plant Biotechnology, Pakistan*
[2] *Helmholtz Centre for Environmental Research GmbH-UFZ, Theodor-Lieser-Str. 4, 06120 Halle, Germany, Department of Soil Ecology,*
[3] *National University of Sciences and Technology (NUST), Dept. of Plant Biotechnology, Pakistan*

Abstract

Plastic pollution is one of the most pressing issues of the growing population and their lifestyle. Polyvinyl chloride (PVC) is one of the most toxic and abundant microplastics (MPs, <5mm) found in sludge and ultimately in agricultural soils. PVC and other MPs pollution have shown serious concerns on ecosystem services. However, the investigations on PVC and biochar (the so-called pro-ecosystem technology) under the real soil-plant system are seriously lacking. Hereby, we investigated the impact of PVC-MPs (0, 0.25 % and 0.5 %, (w/w)) with and without a cotton stalk (Gossipium Hirsutum L.) biochar (0.5 % (w/w)) on soil biological diversity, organic carbon, nitrogen, and enzymes activities within a soil-plant system. PVC-MPs had shown a negative, dose-dependent impact on soil nutrient and enzyme activities thereby reducing overall microbial communities (-60.13 %). However, biochar addition significantly alleviated the hazardous effects of PVC-MPs. Biochar addition improved soil carbon, nitrogen, dehydrogenase, and urease activity. Improved soil conditions resulted in improved microbial abundance by +61.27 %, as indicated by PLFAs biomarkers, except for gram-positive bacteria. The principal component and redundancy analysis of the soil properties, bacterial 16S rRNA gene, and fungal ITS in the biochar amended PVC-MPs treatments revealed that the observed traits formed an obvious cluster. In conclusion, the PVC-MPs contamination in a soil-plant system was not benign while the presence of biochar shielded the toxic effects and sustained ecosystem services. It thus warrants further studies till the maturity of crops to elucidate the MP's effects on crop production and their suspected transfer into the food chain.

Keywords: Biochar, enzymes, microbiome, microplastics

Contact Address: Ghulam Haider, National University of Sciences and Technology (NUST), Dept. of Plant Biotechnology, H-12 Sector Nust, 44000 Islamabad, Pakistan, e-mail: ghulam.haider@asab.nust.edu.pk