Environmental Engineering and Management Journal

December 2024, Vol. 23, No. 12, 2543-2553
http://www.eemj.icpm.tuiasi.ro/; http://www.eemj.eu
http://doi.org/10.30638/eemj.2024.204

"Gheorghe Asachi" Technical University of Iasi, Romania

EFFECTS OF SEWAGE SLUDGE VERMICOMPOST ON SOIL MICROBIAL PHYSIOLOGY AND ENZYMATIC ACTIVITIES IN THE TOMATO RHIZOSPHERE

Stefan Shilev[1]*, Ivelina Neykova[2]

Department of Microbiology and Environmental Biotechnologies, Plant Protection and Agroecology, Agricultural University Plovdiv, 12 Mendeleev Str., Plovdiv 4000, Bulgaria

Abstract

Agriculture is increasingly oriented towards organic land management principles, incrementing soil organic matter, reducing carbon dioxide emissions, covering crops, and so on. Soil organic amendments significantly benefit the soil and plants by increasing organic matter content, ensuring circularity in agriculture, recycling resources, and supplying plants with essential elements. In the present work, we investigated the effect of mineral fertilization (MF) and sludge and agricultural biowastes-derived vermicompost (VC, 25% and 50%) on soil characteristics and tomato growth in pots. VC incorporation had a substantial impact on all aspects of the experiment. It increased soil electrical conductivity (EC), height, and shoot biomass of tomato plants and positively influenced Cu and Zn accumulation. The effect was higher compared to the effect of mineral fertilization. Microbiome activity was strongly affected by VC incorporation, especially in the case of basal respiration. Dehydrogenase and β-glucosidase activities were increased by 456% and 775% when applying MF, and by 1275% and 1282% in the case of VC. The application of VC improved the soil microbial community's capacity to utilize organic compounds from Biolog® EcoPlates™ in the following order: amino acids, carboxylic acids, phenolic compounds and carbohydrates. It increased the Shannon diversity index and substrate richness index by 19.2% and 58.3%, respectively. Finally, this technology is suitable for waste valorization, but the quality of the final product has to be addressed precisely due to possible health and environmental concerns.

Key words: CLPP, sewage sludge, soil microbial activity, tomato, vermicompost

Received: July, 2023; Revised final: June, 2024; Accepted: June, 2024; Published in final edited form: December, 2024

* Author to whom all correspondence should be addressed: e-mail: stefan.shilev@au-plovdiv.bg; Phone: +359 32 654266