World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:16, No:12, 2022

Glasshouse Experiment to Improve Phytomanagement Solutions for Cu-Polluted Mine Soils

Authors : Marc Romero-Estonllo, Judith Ramos-Castro, Yaiza San Miguel, Beatriz Rodríguez-Garrido, Carmela Monterroso

Abstract : Mining activity is among the main sources of trace and heavy metal(loid) pollution worldwide, which is a hazard to human and environmental health. That is why several projects have been emerging for the remediation of such polluted places. Phytomanagement strategies draw good performances besides big side benefits. In this work, a glasshouse assay with trace element polluted soils from an old Cu mine ore (NW of Spain) which forms part of the PhytoSUDOE network of phytomanaged contaminated field sites (PhytoSUDOE Project (SOE1/P5/E0189)) was set. The objective was to evaluate improvements induced by the following phytoremediation-related treatments. Three increasingly complex amendments alone or together with plant growth (Populus nigra L. alone and together with Tripholium repens L.) were tested. And three different rhizosphere bioinocula were applied (Plant Growth Promoting Bacteria (PGP), mycorrhiza (MYC), or mixed (PGP+MYC)). After 110 days of growth, plants were collected, biomass was weighed, and tree length was measured. Physical-chemical analyses were carried out to determine pH, effective Cation Exchange Capacity, carbon and nitrogen contents, bioavailable phosphorous (Olsen bicarbonate method), pseudo total element content (microwave acid digested fraction), EDTA extractable metals (complexed fraction), and NH4NO3 extractable metals (easily bioavailable fraction). On plant material, nitrogen content and acid digestion elements were determined. Amendment usage, plant growth, and bioinoculation were demonstrated to improve soil fertility and/or plant health within the time span of this study. Particularly, pH levels increased from 3 (highly acidic) to 5 (acidic) in the worst-case scenario, even reaching 7 (neutrality) in the best plots. Organic matter and pH increments were related to polluting metals' bioavailability decrements. Plants grew better both with the most complex amendment and the middle one, with few differences due to bioinoculation. Using the less complex amendment (just compost) beneficial effects of bioinoculants were more observable, although plants didn't thrive very well. On unamended soils, plants neither sprouted nor bloomed. The scheme assayed in this study is suitable for phytomanagement of these kinds of soils affected by mining activity. These findings should be tested now on a larger scale.

Keywords : aided phytoremediation, mine pollution, phytostabilization, soil pollution, trace elements
Conference Title : ICBTE 2022 : International Conference on Biogeochemistry of Trace Elements
Conference Location : New York, United States
Conference Dates : December 09-10, 2022