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Assessment of Phytotoxicity of Potable Water Treatment Plant Sludge-bound Compost Pellets on Seed Germination of Radish (*Raphanus sativus* L.)

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Abstract

Binding loose compost into pellets needs different binding materials. Maintenance of pellet stability highly depends on the binding materials used. Potable water treatment plant sludge (WTPS) has the potential to be used as a binding material due to the high content of clay, organic matter, and nutrients. However, compost and WTPS may contain heavy metals, toxic compounds, salts, and growth inhibitors. Therefore, the determination of the phytotoxicity of WTPS bound compost pellets is essential before amending them to the soil. The present study aimed to assess the phytotoxicity of different pelleted compost using seed germination bioassay of *Raphanus sativus* L. Four compost pellets were considered (T1: commercial compost pellet (100% compost), T2: commercial integrated pellet (90% compost+10% inorganic fertilizer), T3: WTPS-bound compost pellet (90% compost+10% WTPS), T4: WTPS-bound integrated pellet (80% compost+10% WTPS+10% inorganic fertilizer)) and pellet aqueous extracts (PAE) were prepared, respectively. Distilled water was used as the control. The dilution sequence of PAE as 50% and 100% were tested for seed germination in Petri dishes in a randomized design with three replicates. pH, EC, and selected heavy metals (Al, Zn, Cu and Cr) were determined in PAE. RSG% (Relative Seed Germination %), RRG% (Relative radicle Growth %), and GI% (Germination Index) were calculated for all the PAE after 72 hours. The PAE had a pH range from 6.8-7.2. The Cr was not detected in all 100% PEA. The highest levels of Al and Zn were detected in 100% PAE of T1. All the treatments in both 50% and 100% PAE showed GI% higher than 80% except the 100% PAE of commercial integrated pellet (T2) and WTPS-bound integrated pellet (T4). The PAE from the T2 and T4 showed low RSG% and RRG% and thereby the GI% is low due to high EC in PAE. The GI% of 100% PAE in T2 and T4 was 32.33% and 67.25%, respectively. The lowest values for RSG% and RRG% were recorded for T2 as 44.44% and 72.75%, respectively. Spearman's Rank Correlation coefficients were calculated for EC with RSG%, RRG%, and GI% and all variables showed negative correlations as (-0.44), (-0.97), and (-0.69), respectively. This indicates that high EC reduces radical growth and seed germination. PAE at 100% concentration levels of commercial integrated pellet showed high phytotoxicity, and WTPS-bound integrated pellet showed less phytotoxicity while other treatments did not show any sign of phytotoxicity. All the PAE at 50% concentration level were free from phytotoxicity. Hence, 10% WTPS in w/w basis can be used as a binding agent in pelletizing loose compost. Different WTPS concentrations should be tested in binding process for its optimum utilization.

Keywords: Bioassay, Compost, Phytotoxicity, Radish, Water treatment plant sludge

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