Comparison of the effects of sewage sludge and compost on maize plant physiology

Dávid Kaczur[1], Makoena Joyce Moloi[2], Lóránt Szőke[3], Brigitta Tóth[1*]

[1]University of Debrecen, Faculty of Agricultural and Food Sciences and Environmental Management, Institute of Food Science, Debrecen, Hungary
[2]University of the Free State, Faculty of Natural Science, Department of Plant Sciences, Bloemfontein, South Africa
[3]Department of Plant Nutrition, Faculty of Agriculture, University of Zagreb, Zagreb, Croatia
*Correspondence: btoth@agr.unideb.hu

Abstract

Looking for alternative plant fertilizer materials is crucial because of continuously increasing food demand and growing human population. This experiment hypothesized that the measured parameters of maize (*Zea mays* L. cv. Armagnac) linearly change with increasing concentrations of sewage sludge and compost (0% as control, 25%, 50%, and 75% as m/m%) treatments at the 3-leaf stage. In addition, the goal of this study was comparing the effects of sewage sludge and compost on maize's characteristics in a greenhouse pot experiment.

The results showed that all three of the applied compost concentrations had positive effects on the initial growth of the plants, while sewage sludge increased plant height at 25% and 50% treatments compared to the control. All the applied treatments increased chlorophyll-a, chlorophyll-b, and carotenoid contents related to the control. The proline content indicates that all treatments stressed the plants, though the nature and extent of the stress are not clear yet. In addition, the amount of malondialdehyde (MDA) and the activity of superoxide dismutase (SOD) did not change significantly compared to the control. This indicates that there is no correlation among MDA, proline content, and SOD activity in this experiment. Chlorophyll-b content was 2.8, 2.5, and 3.2 times higher at 25%, 50%, and 75% sewage sludge treatment relative to compost treatment. Concerning carotenoid these values were 33%, 25%, and 41% higher also when plants were grown on sewage sludge. The concentration of proline and content of MDA were not significantly different between 25% sewage sludge and compost treatment. At 50% and 75% treatments, MDA content was 25% and 33% higher while the proline concentration was 37% and 53% higher in the sewage sludge treated plants respectively. The activity of SOD was significantly higher at 25% and 75% sewage sludge concentrations relative to the compost treatments.

Keywords: abiotic stress, antioxidant enzyme, chlorophyll, plant stress physiology, proline, superoxide dismutase