INVESTIGATION OF PHOSPHORUS CYCLE DYNAMICS IN A SEWAGE SLUDGE COMPOST EXPERIMENT

Csilla Almási[1,2]*, Viktória Orosz[2], Ibolya Demeter[2], Zsolt Bogdányi[2], Tímea Tóth[3], István Henzsel[2], Marianna Makádi[2]

[1]University of Debrecen, Kálmán Kerpely Doctoral School, Debrecen, HUNGARY
[2]University of Debrecen, Research Institute of Nyíregyháza, Institutes for Agricultural Research and Educational Farm, Nyíregyháza, HUNGARY
[3]University of Debrecen, Research Institute of Újfehértó, Institutes for Agricultural Research and Educational Farm, Újfehértó, HUNGARY

*corresponding author: csilla.almasi@agr.unideb.hu

The increasing price of mineral fertilizers and the depletion of global rock phosphate reserves make the search for sustainable alternatives imperative. Sewage sludge compost (SSC) can serve as a low-cost phosphorus source. SSC not only serves as a P source but also improves soil physical, chemical and biological properties. This study aims to examine the long-term effects of regular SSC application on certain elements of the phosphorus cycle in a small-plot experiment established in 2003 in Nyíregyháza on Arenosol soil. The experiment consists of four treatments (0, 9, 18, 27 t ha^{-1} SSC), incorporated into the soil every three years. The results showed that higher available phosphorus levels compared to the control plot resulted in greater biomass production and more efficient phosphorus utilization in rye. Acid and alkaline phosphatase activity also influenced the forms of available phosphorus in the soil. Principal component analysis revealed that total phosphorus, ammonium lactate-extractable P_2O_5, and acid phosphatase were the key factors distinguishing the SSC treatments. Regular SSC application is shown to be a sustainable strategy which contributes to soil fertility and highlights the contribution to not only total but also plant-available phosphorus, while emphasizing the crucial role of soil microorganisms in nutrient management. SSC can reduce the dependence on mineral phosphorus fertilizers.