RETASTE Conference Abstracts
Vol. 3 RETASTE-NRF-359-Poster
Athens, Greece, 27-29 September, 2023

rethink food resources, losses, and waste 2023 retaste

Struvite from Wastewater can Replace Conventional Phosphorous Fertilization in a Maize Crop

C. Mancho, S. Diez-Pascual, A. Gutiérrez, J.Alonso, M. Gil-Diaz and M.C. Lobo

IMIDRA (Instituto Madrileño de Investigación y Desarrollo Rural Agrario y Alimentario). Finca El Encin, A-2, km 38,2. Alcalá de Henares (Madrid)28805 Spain.

Abstract

Fertilizer demand is expected to increase in the long term due to a growing world population, which will reach 9.8 billion people by 2050, according to the United Nations forecast (UNDESA, 2017). Phosphorus (P), like nitrogen (N) and potassium (K), is an essential nutrient for plants. The world's main source of P (phosphate rock) is a non-renewable resource, and reserves are becoming scarce and expensive, resulting in P-fertilizer supply problems (Reijinders, 2014). This threatens food security in the long term, especially in countries with no reserves of this mineral. Therefore, the recovery of this nutrient should be encouraged. There are currently several technologies that could cover the need for P fertilizers for global food production. In addition, it must be taken into account that the European Commission has set a goal of a 30% reduction of non-renewable resources for fertilizer production (Chojnacka et al., 2020). In this sense, municipal wastewater is a promising source of P that could replace P derived from phosphate rock. The aim of this study is to evaluate the fertilizing capacity of struvite ($MgNH_4PO_4 \cdot 6H_2O$) from wastewater treatment plant as phosphorus fertilizer for a maize crop. A field trial was carried out in 7x3 m plots. Application of struvite (STR) supplemented with a N source was compared with the application of a conventional mineral fertilizer (NPK). The combination of struvite with urea (STR+N) and thermally dried sewage sludge (STR+ST) was tested. A total of 120 kgP_2O_5/ha was applied. In relation to N, one third of the total dose (120KgN/ha) was applied as bottom fertilization and two times more as cover fertilization at two stages (30 and 75 days after sowing). Four replicates per treatment were used. After harvest, the yield of the different treatments was evaluated by measuring the plant biomass obtained (leaf and grain). Soil samples were also analyzed. The results showed a slight increase in both the total biomass (stems, leaves and cobs) and the amount of grain in the treatments with struvite supplemented with a nitrogen source, either in the form of ST or urea, compared to the NPK treatment. No significant differences in nutritional composition were found among the different treatments, although a trend towards an increase in P content was observed in STR+ST treatment. Soil fertilization with struvite supplemented with a nitrogen source, showed good results for maize crop, obtaining yield values and effects on plant and soil comparable to those obtained with conventional mineral fertilization. The use of

struvite in combination with other fertilizers, in order to obtain adequate formulations for crops, would lead to a reduction in the use of conventional mineral fertilizers and consequently in greenhouse gas emissions, contributing to climate change mitigation.

Keywords: Phosphorous, leaching, soil, fertilizers, wastewater

References

Chojnacka, K.; Moustakas, K.; Witek-Krowiak, A. 2020. Bio-Based Fertilizers: A Practical Approach towards Circular Economy. Bioresour. Technol., 295, 122223, doi:10.1016/j.biortech.2019.122223
Reijnders, L. 2014. Phosphorus Resources, Their Depletion and Conservation, a Review. Resour. Conserv. Recycl., 93, 32–49, doi:10.1016/j.resconrec.2014.09.006.
UNDESA (United Nations, Department of Economic and Social Affairs, Population Division) 2017. World Population Prospects: The 2017 Revision, Key Findings and Advance
Tables; Working Paper No. ESA/P/WP/248; United Nations: New York, NY, USA, 2017.

Acknowledgments: Financial support by Canal de Isabel II (Comunidad de Madrid)