INI2020
Abstract for oral presentation

Assessing nitrogen availability in biobased fertilizers: effect of vegetation on mineralization patterns

Hongzhen Luo, Ana A. Robles-Aguilar, Ivona Sigurnjak, Evi Michels, Erik Meers

Department of Green Chemistry & Technology, Faculty of Bioscience Engineering, Ghent University, Ghent, Belgium

E-mail: Hongzhen.Luo@Ugent.be

Abstract

Biobased nitrogen (N) fertilizers derived from agro-waste have the potential to substitute synthetic N fertilizer and contribute to more sustainable agriculture. However, N availability in fertilizers is usually determined by laboratory incubation, excluding the effect of plant growth. The present work compared the N dynamics in soil with and without vegetation, under fertilization of synthetic N fertilizer (calcium ammonium nitrate, CAN) and biobased N fertilizers (pig manure and liquid fraction of digestate). The main objective was to estimate the N availability of biobased products under vegetation and verify the results from the incubation experiment.

Keywords: nitrogen, biobased fertilizer, vegetation, mineralization

1. Introduction

Nitrogen (N) fertilizers have made an essential contribution to maintaining an adequate food supply for the world's increasing population. Compared to synthetic N fertilizers supplying N in 100% mineral form, biobased N fertilizers also supply organic N which is not directly available. Thus, the N availability of biobased fertilizers should include the original mineral N in fertilizers and those mineralized from organic N by microbial activities (Fouda, S., 2011). Laboratory incubation is considered an effective tool for predicting N release from biobased fertilizers (Rigby, H., 2016). However, In field practice N dynamics in the soil can also be affected by plants' root development through N uptake, root exudates, rhizosphere microbes, and their interactions. Therefore, to fully map the N dynamics in soil after fertilization, the effect of plant growth needs to be included and compared with non-planted conditions to determine the effect of vegetation on N dynamics.

2. Materials and methods

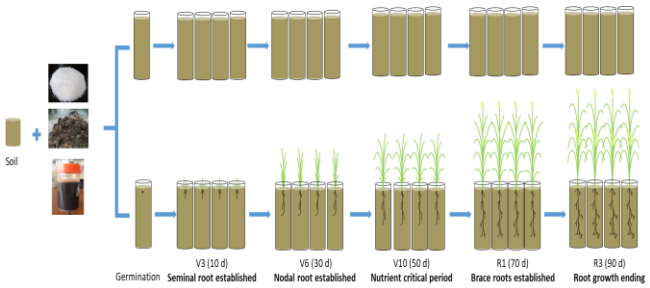

Fig. 1: Experimental setup

An incubation experiment was conducted in parallel with a plant growth experiment using maize (Zea mays L.) in 45-cm-deep tubes for 90 days. The tested fertilizers, CAN (as synthetic N fertilizer), pig manure and liquid fraction of digestate were applied at 150 kg Ntot/ha in the two experimental setups, by mixing with soil before planting.

During the experiment on 10, 30, 50, 70 and 90 days after germination soil samples were collected, and plant shoot and root biomass were measured. N dynamics were investigated by analyzing the amount and form of N in soil and plant samples.

3. Hypothesis

We hypothesize that a higher rate of N mineralization will be observed under biobased fertilizer treatments in the maize growing experiment as compared to the incubation experiment. This would indicate a positive effect of root growth on N mineralization, as root proliferation may be important in capturing N from organic sources, in competition with microbes. Data processing is currently on-going.

Acknowledgments

The research is done as a part of the Nutri2Cycle project that receives funding from the European Union's Horizon 2020 Framework Programme for Research and Innovation under Grant Agreement no 773682.

References

Fouda, S., 2011. Nitrogen availability of biogas residues (Doctoral dissertation, Technische Universität München).

Rigby, H., Clarke, B.O., Pritchard, D.L., Meehan, B., Beshah, F., Smith, S.R. and Porter, N.A., 2016. A critical review of nitrogen mineralization in biosolids-amended soil, the associated fertilizer value for crop production and potential for emissions to the environment. *Sci. Total Environ.*, 541, pp.1310-1338.