FIRST ANALYSIS OF THE NITRATE LEACHING RISK FOR DIFFERENT FERTILISERS IN THE PERSEPHONE PROJECT

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INTRODUCTION

In the context of the Project «Perséphone: Intégration de la filière biogaz dans la nouvelle Bio-économie», financed by the European Regional Development Fund 2014-2020 INTERREG VA «Greater Region», our non-profit association is in charge of five organic and chemical fertilization field trials (2017-2019). This paper is based on the first data collected through 2017 and will present the analysis of the nitrate leaching risk for that year under permanent cut grassland. Koszela et al. (2015) demonstrated the fertilisation capacity of biogas residues, while Odlare et al. (2007) observed that biogas residues enhanced the proportion of metabolically active microorganisms, nitrogen mineralization capacity and had no negative effects on either chemical or microbiological properties of the soil. On the other hand, in a study performed by Wang et al. (2016), the application of biogas residues resulted into increased nitrogen volatilization. Therefore, to study the environmental impact, it is important to estimate soil nitrate leaching risk, especially during autumn, the focus point of this presentation. This study will also help to assess the value of biogas residues as an organic fertilizer and to evaluate its environmental benefits, to compare the impact of each tested fertilizer on the yield, microbial activity and evolution of soil physicochemical properties, and to assess the environmental risk induced by an organic based fertilisation scheme on a permanent mown meadow.

MATERIALS AND METHODS

In this ongoing field trial, four different fertilisers are tested in three areas (Emmels (Be), Grendel (Be) and Laneuvelotte (Fr)). The fertilizers applied are i) local biogas residues at 350 units of total N/ha, ii) biogas residues of Faascht farm (Grendel, Be) at 230 U of N/ha, iii) local manure at 230 U of N/ha and iv) ammonium nitrate at 230 U of N/ha, which are compared to the unfertilized control (Te) and among each other. Nitrate leaching risk is indicated by mineral N measurement in soils which takes place in February, before fertilizer application, and in October, after the last forage harvest. This is the recommended strategy in Belgium. A high nitrate content in soil will increase the potential nitrate leaching risk. As Vandenberghe cited (2013), during the year, nitrogen measurements are taking place by GxABT of Uliège and UCL to provide reference for the farmers. Soil cores of 90 cm are collected and divided in layers of 0-30, 30-60 and 60-90 cm which subsequently are analysed for nitrate content. For our statistical analysis we used R studio software (R version 3.4.3 (2017-11-30)).

RESULTS AND DISCUSSION

An ANOVA test performed shows that the risk for nitrate leaching differs in regard of the treatments ($p<0.001$). The post-hoc Tukey's analysis demonstrates significant differences between variants. This first assessment of nitrogen leaching risk reveals no significant differences between the 2 biogas residues treatments and the control ($p<0.05$). A similar conclusion has been drawn for the manure variant ($p<0.05$) though values are slightly higher. On the contrary, the ammonium nitrate variant (230 U of N/ha) shows a significant difference compared to the control ($p< 0.001$). In addition, the average value of the soil nitrate concentration under the application of ammonium nitrate is considerably higher compared to the rest of the variants, as demonstrated in the figure 1.

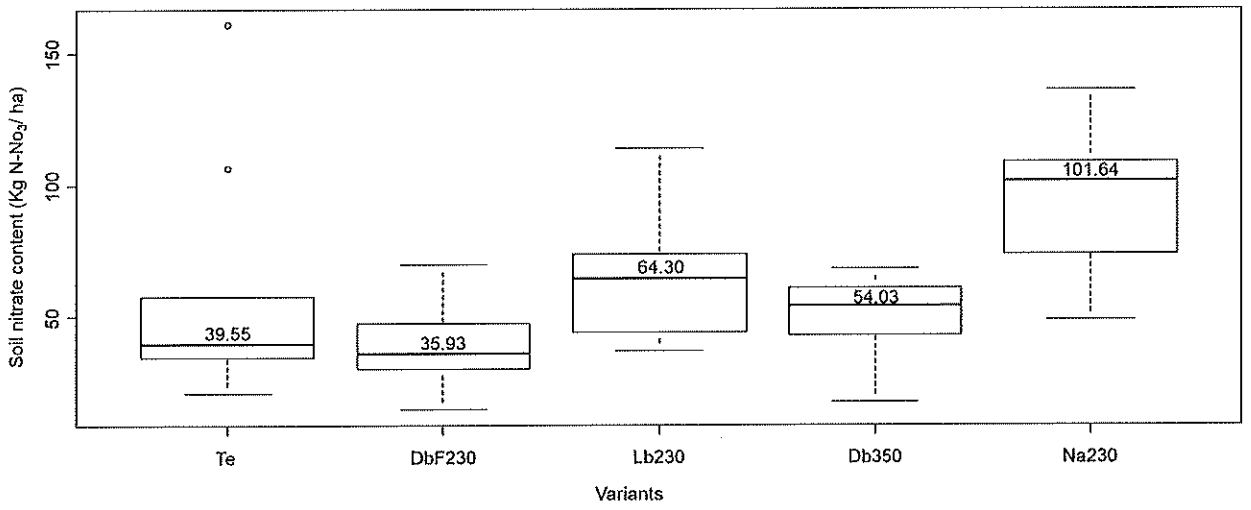

Figure 4: Box plot of soil nitrate content (kg N-NO_3/ha) after the application of four different fertilizers. Caption: Te = Control, DbF230 = Biogas residues of Fascht farm at 230 U of N/ha, Lbl230 = local manure at 230 U of N/ha, Db350= local biogas residues at 350 U of N/ha, Na230 = ammonium nitrate at 230 U of N/ha

CONCLUSION

Our data show that the use of biogas residues and manure do not increase the values of nitrate leaching even at the maximum dose of 350 U of N/ha. In addition, it is important to note that part of the nitrogen present in biogas residues and manure is found in the organic matter. The release of this organic nitrogen depends on ammonification and nitrification. These processes are retroactive in regard of the fertilisation and highly depend on the weather conditions. Organic and mineral fertilisation will continue throughout the following years and the measurements obtained will indicate if the organic matter, present in biogas residues and manure, has the potential to increase or mitigate nitrate leaching risk.

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