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THE NITRIFICATION PROCESS IN SOIL: THE IDENTIFICATION OF N_2O SOURCES

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Introduction

The increase in atmospheric concentrations of nitrous oxide N_2O over the last 20 years has attracted considerable scientific attention from a variety of disciplines, since N_2O is not only one of the main greenhouse gases but also contributes to the destruction of the ozone layer.

Denitrification and nitrification are the main biological processes leading to N_2O emissions from soil. Denitrification is when soil is wet and anaerobic, but nitrification is if soil conditions are aerobic.

Understanding the relative impact of each process on total N_2O emissions is essential in modelling and forecasting changes in N_2O flows under different environmental conditions. Nowadays N_2O isotope measurements are considered to be an important method for modelling and understanding the nitrogen cycle and budget. The N_2O molecule has an asymmetric linear structure with two nitrogen atoms N = N = O resulting in one of the isotopes 15N, which may be both Nα and Nβ or simply α and β.

Matherials and Methods

The 26 mixed soil samples harvested in the month of June 2019 in the holding of "Pēterlauki" at the Latvia University of Life Sciences and Technologies.

Sampling was carried out at 12 test fields and in the control zone where the sample collected from each field was weighed in two 3 l plastic buckets each at 1.8 kg.

A pattern of moisturing samples was designed for wet aerobic and wet anaerobic soil. Moisturing samples with 150 ml and 300 ml of water was carried out every three days.

N_2O isotope measurements were performed using Picarro G5131-i twice a week for a total of six measurement sessions where each sample was measured in 3 times.

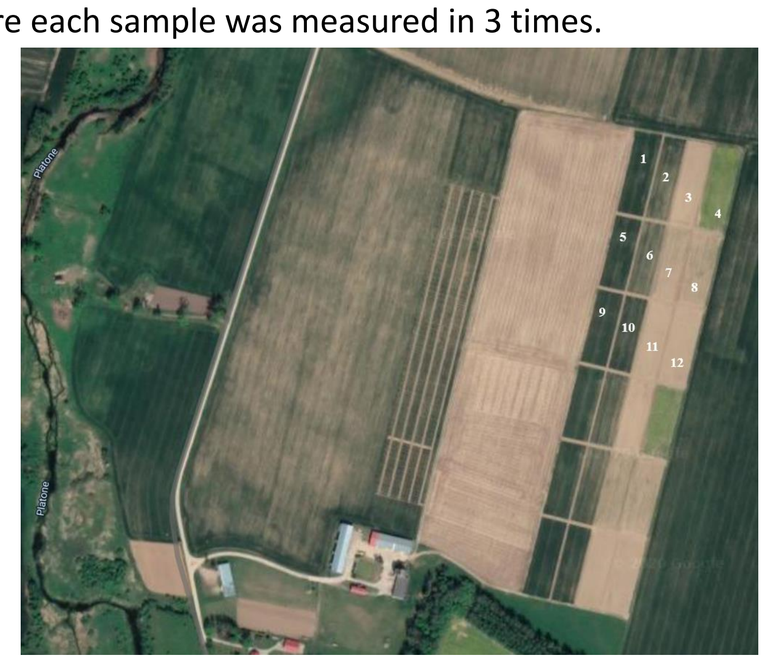

Figure 1 The Location of soil sampling plots.

Figure 2 The measurement system using Picarro G5131-i.

Results

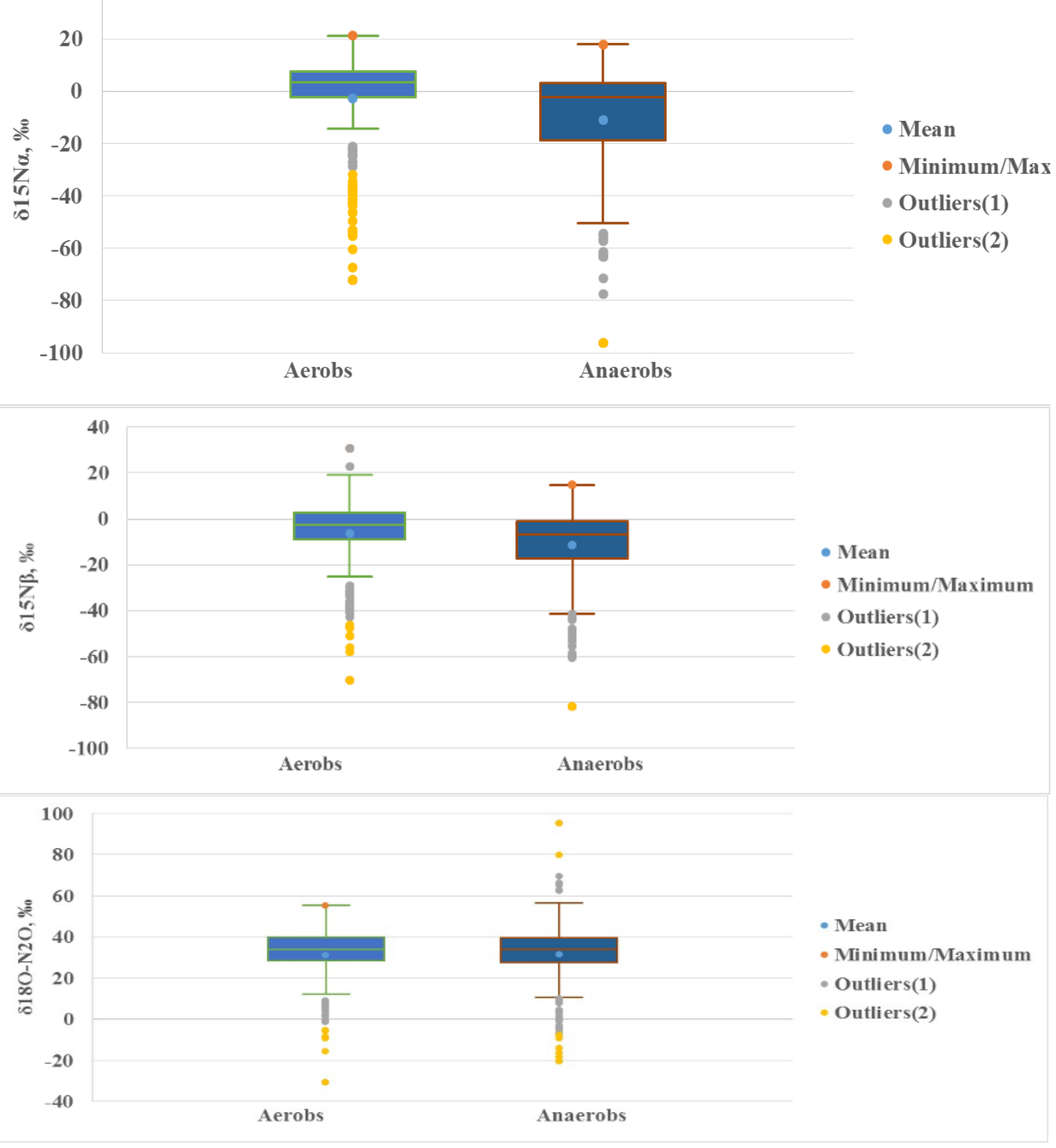

Figure 3 The results of N_2O isotope δ15N α, isotope δ15N β δ 18O by moisture in soil.

Conclusion

The proportion of N_2O isotope δ15N α is higher in aerobic than in anaerobic conditions, similar to the N_2O isotope δ15N β, while the proportions of the isotopes of δ 18O are similar in aerobic and anaerobic conditions. The results have been confirmed in previous studies have shown that aeration of soil have significant impact of the N_2O emissions formation process associated with nitrification and denitrification processes. In anaerobic soil samples, the ratio of δ 15N α and δ 15N β was lower than that of aerobic soil samples. As N_2O is generated in soil as a result of the metabolism of micro-organisms, and the existing measurements show a high dispersion, it is necessary to carry out an analysis of the N_2O complexes, taking into account not only the soil humidity but also the effects of plants and the type of soil treatment, as well as the impact of soil chemical extraction on the isotope proportions of N_2O.