Impact of tillage on greenhouse gas emissions by a maize crop and dynamics of N_2O fluxes.

Margaux Lognoul[1], Nicolas Theodorakopoulos[2], Marie-Pierre Hiel[2], Bernard Bodson[2], Bernard Heinesch[1] and Marc Aubinet[1].

N_2O is a potent greenhouse gas produced by nitrifying and denitrifying microorganisms. In agricultural soils, the uppermost soil layer constitutes the main source of N_2O emissions, which are driven by climatic events such as precipitations, but also by soil properties such as N and C availability. Farming practices like tillage can influence these soil properties and consequently affect greenhouse gas emissions.

Between June and October 2015, CO_2 and N_2O fluxes were measured on a maize crop located in Gembloux (Belgium), using a homemade automated set of dynamic closed chambers. Two tillage treatments were compared: reduced tillage and conventional tillage, both applied since 2008.

A significant impact of tillage was observed on GHG emissions: mean emissions were twice larger (CO_2) and six times larger (N_2O) under reduced tillage than in conventional tillage, presumably because of higher total organic C and total N content, and greater microbial biomass in the upper soil layer. An emission peak of N_2O was observed in both treatments mid-June less than 24h after heavy precipitations. The absence of peak later during the experiment was attributed to maize growth and competition for soil N. In reduced tillage, soil temperature explained ~10% of N_2O background flux variability, but no significant relationship was found for conventional tillage. No clear pattern (e.g. daily cycle) was identified in N_2O background fluxes.

Our results highlight the need for continuous measurements as peaks can happen several months after fertilization, and the need for high temporal resolution measurements to understand the dynamics behind N_2O emissions.

[1]TERRA Atmosphere Ecosystems Exchanges, Gembloux Agro-Bio Tech (Université de Liège) – 2 Passage des Déportés 5030 Gembloux, Belgium.
[2]AgroBioChem Department, Gembloux Agro-Bio Tech (Université de Liège) – 2 Passage des Déportés 5030 Gembloux, Belgium.

Contact :
margaux.lognoul@ulg.ac.be