Experimental No Farming Oxygenation CO In N

Background
- N₂O is produced by soil nitrifying and denitrifying microorganisms. In agricultural soils, the upper layer constitutes the main source of N₂O emission.
- Oxygenation conditions in pores (WFPS) and soil temperature affect the activity of N₂O producing microorganisms. Determining variables also include soil properties like N and C availability, and soil pH.
- Farming practices such as tillage can influence these soil properties and consequently affect GHG emissions.
- However, there is no consensus concerning the effect of reduced and conventional tillage on GHG emissions by agricultural soils in temperate regions.

Results
Impact of tillage on CO₂ and N₂O fluxes
- CO₂ and N₂O emissions were significantly affected by tillage treatments (Fig. 2).
  - Reduced tillage distributes crop residues only in the uppermost layer, significantly influencing soil properties (Fig. 3c-f).
  - We assume that it created more favorable conditions for microorganisms growth and for production of CO₂ and N₂O.

Temporal variability of N₂O emissions
- N₂O emission peak in both treatments in mid-June, and background fluxes afterwards (Fig. 3c).
  - N₂O production was triggered by an increase of WFPS (Fig. 3a) following heavy precipitations, leading to an emission peak less than 24h after the rainfall in both treatments.
  - Later on, the absence of important peak after rainfall could be due to an increased competition for soil N between microorganisms and growing maize (Fig. 3b).

Drivers of N₂O background fluxes
- In reduced tillage, soil temperature explained ~10% of N₂O background flux variability (Fig. 4).
  - Increased soil temperature stimulates of microbial activity (agreement of N₂O and CO₂ fluxes, Fig. 3c-d). WFPS added in the linear regression explained ~1% of the variability.
- In conventional tillage, no significant link between N₂O background fluxes and soil temperature nor WFPS was found.
- No clear pattern (e.g. daily cycle) in N₂O background flux was identified.

Conclusions
- Using automated dynamic closed chambers, we measured CO₂ and N₂O emissions in a maize crop during 4 months and compared fluxes in parcels under conventional tillage and reduced tillage.
- Reduced tillage, by limiting incorporation of crop residues to the uppermost soil layer, created more favorable conditions for CO₂ and N₂O emissions.
- N₂O emission peaks triggered by an increase of WFPS can happen long after fertilization (2 months), highlighting the need for continuous measurements.
- N₂O background fluxes in reduced tillage showed to be slightly influenced by soil temperature, however no daily pattern was identified. Need is for more measurements with high temporal resolution to identify background flux dynamics.
- The use of our homemade automated system of closed chambers was well suited for this kind of experiment.

Material & Methods
Experimental set up and timing
- Experimental site: maize crop located in Gembloux, Belgium (silt loam under oceanic temperate climate).
- Treatments compared: reduced tillage (crop residues incorporation at 10-cm depth) and conventional tillage (crop residues incorporation at 10-cm depth + winter ploughing at 25-cm depth) since 2008.
- CO₂ and N₂O flux measurements: homemade automated dynamic closed chambers (Fig. 1).

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