Reduced Tillage generates higher N\textsubscript{2}O emissions: results of continuous chamber-based measurement in a winter wheat field.

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**Objectives**

- What is the impact of soil tillage on N\textsubscript{2}O and CO\textsubscript{2} fluxes?
- What is the influence of fertilization events, climate on N\textsubscript{2}O emission dynamics?

**Method**

**Experimental site**
- Gembloux Belgium, Silt loam region
- Crop: winter wheat
- Since 2008:
  - Crop residues return
  - Differentiated tillage
- Two parcels studied
  - Reduced Tillage (RT): annual stubble breaking (10 cm) and seedbed preparation (10 cm)
  - Conventional Tillage (CT): annual stubble breaking (10 cm), seedbed preparation (10 cm) and winter ploughing (25 cm)
- 3 fertilizations with UAN solution
  - 1: 04/4/02: 59 kg N ha\textsuperscript{-1}
  - 2: 04/22: 66 kg N ha\textsuperscript{-1}
  - 3: 05/19: 75 kg N ha\textsuperscript{-1}

**Gas Fluxes Measurements**
- Continuous measurement with a high temporal resolution (4 hours).
- CO\textsubscript{2} and N\textsubscript{2}O fluxes measurement with homemade automated closed chambers
- In each parcel 8 chambers connected to CO\textsubscript{2} and N\textsubscript{2}O analyzers (figure 1)
- Chambers close consecutively
- 8 flux measurement per cycle
- 1 mean flux every 4 hours

**Additional measurements**
- Surface soil water content and temperature
- Every fortnight in each parcel
- Soil pH
- Soil organic carbon
- Nitrogen pools: Total Nitrogen, NO\textsubscript{3} and NH\textsubscript{4}
- At chamber withdrawal time, beneath every chamber
- NO\textsubscript{3}
- NH\textsubscript{4}

**Fertilization events and water give the rhythm to the nitrogen dynamic. Illustration with the RT parcel**

- Higher N\textsubscript{2}O emissions can be connected with the higher soil organic carbon, total nitrogen and nitrate contents in the RT parcel (figure 4).
- Differences in soil C & N content probably translate into greater microbial activity.
- On the other hand, CO\textsubscript{2} emissions are higher in the CT parcel. Residues having been included 4 months before measurements started, mineralization before the campaign might originate that difference.

**Larger N\textsubscript{2}O emissions in parcels with Reduced Tillage than in parcels with Conventional Tillage while CO\textsubscript{2} fluxes are lower (figures 2 and 3).**

**Nitrification episode?**

- Nitrification input of NO\textsubscript{3} and NH\textsubscript{4}
- Post-fertilization dynamics
  - Decrease in soil NH\textsubscript{4}
  - Soil NO\textsubscript{3} still rises after fertilizations 1 \& 2
- But not after highly relative WFPS during peak occurrences

**Denitrification episode?**

- Relatively high WFPS during anoxic conditions

**Do N\textsubscript{2}O flux peaks result from both nitrification and denitrification?**

**Under Reduced Tillage: Spatial variability of N\textsubscript{2}O fluxes is related with NO\textsubscript{3} concentration in soils**

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