P347 Effects of Long-term Reduced Tillage on Greenhouse Gas Emissions, Soil C and N Dynamics and Crop-weed Responses under Ambient and Reduced Rainfall

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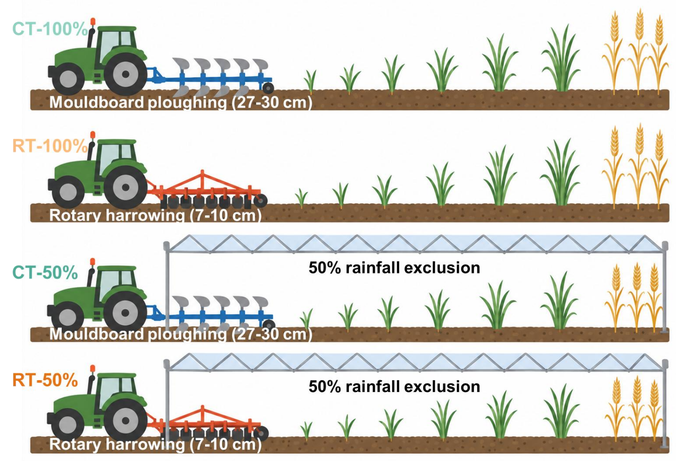
INTRODUCTION

- Increasing **frequency of drought** challenges temperate cropping systems.
- **Reduced tillage (RT)** may enhance soil water retention and carbon (C) storage, but its effects on soil C and nitrogen (N) cycling, greenhouse gas (GHG) emissions, and crop performance under **reduced rainfall** require further investigation.

QUESTION AND HYPOTHESES



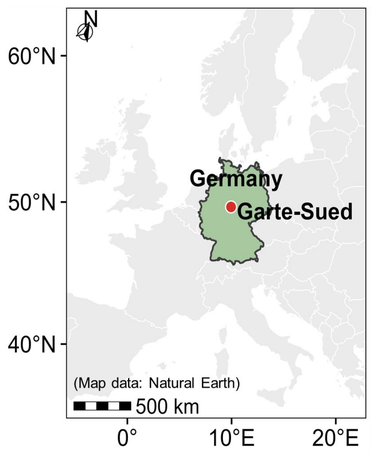
CT = conventional tillage; RT = reduced tillage

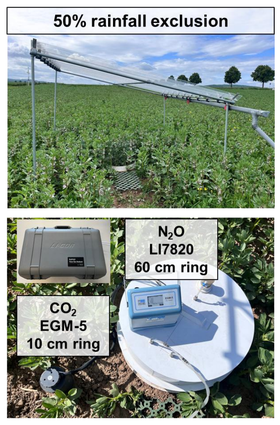
How do tillage, rainfall, and their interactions affect soil water and N dynamics across soil depths, GHG emissions and crop performance?

H1: Tillage × rainfall → reduced rainfall ↓ cumulative N_2O under RT

H2: Tillage × rainfall → reduced rainfall ↓ faba bean yield under CT

METHODS





Experimental design

- **Site:** Garte-Sued long-term field experiment, Göttingen, Germany
- **Soil:** silty loam Haplic Luvisol
- **Tillage history:** CT vs RT since 1970 (~56 years)
- **Fertilizer:** Urea ammonium nitrate solution (UAN), 160 L ha^{-1} (58 kg N ha^{-1})

Management practices

Tillage

Sowing

Fertilization

Harvest

Stubble incorporation

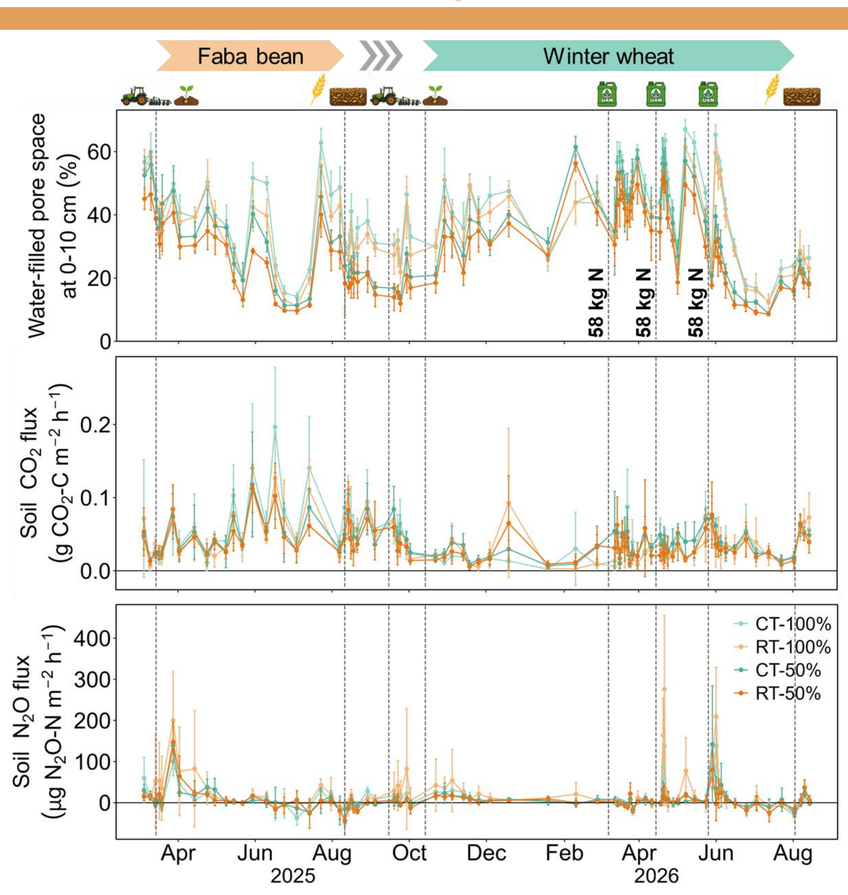
Measurements

GHG → Soil CO_2 and N_2O fluxes

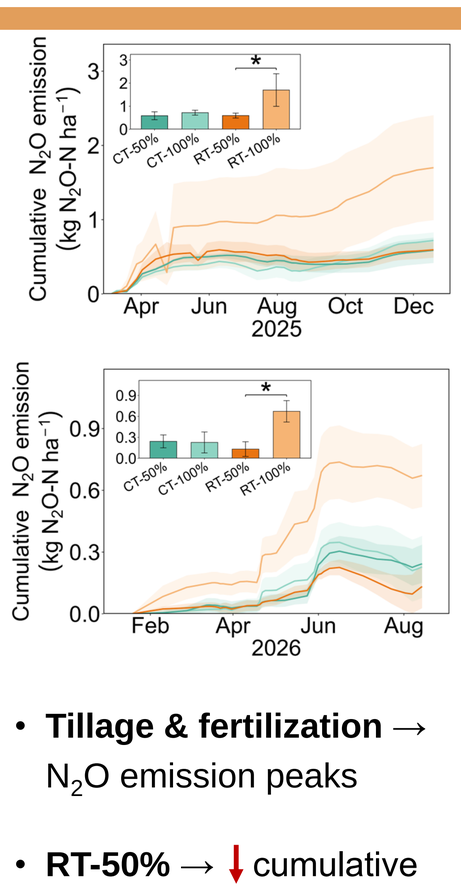
Soil → Soil moisture, pH, mineral N, microbial biomass

Crop → Height, chlorophyll, yield, weed, C & N content

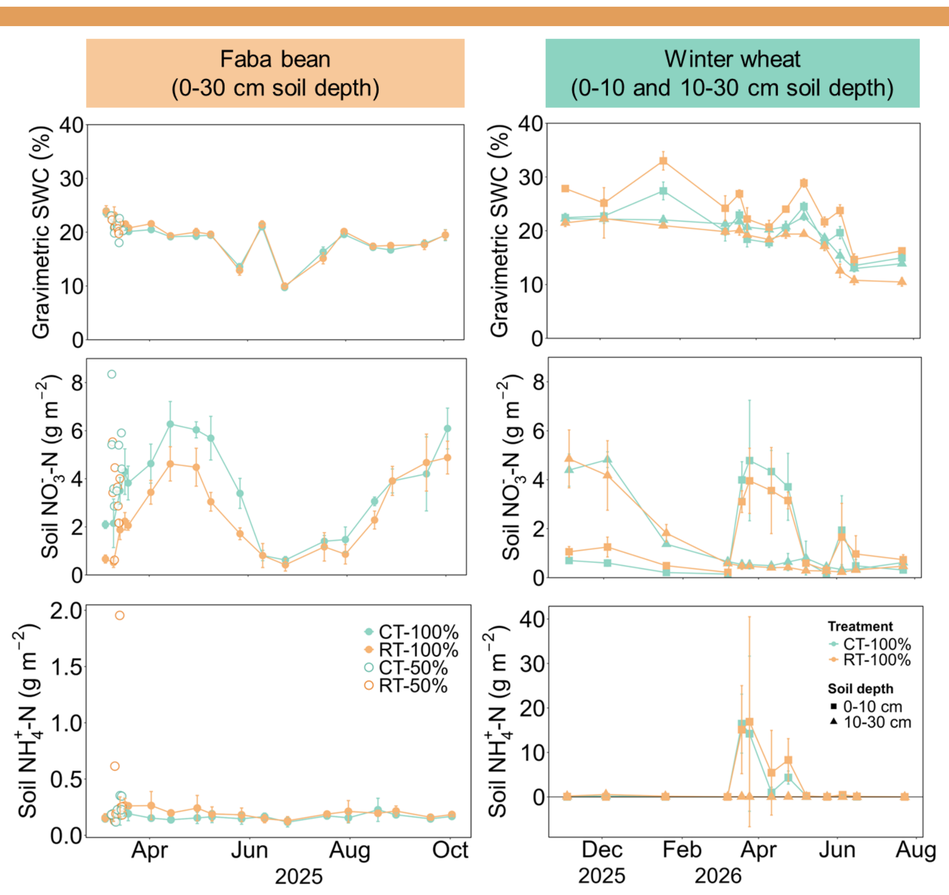
PRELIMINARY RESULTS



- Cover cropping period before March 2025



- **Tillage & fertilization** → N_2O emission peaks
- **RT-50%** → ↓ cumulative N_2O vs. RT-100%

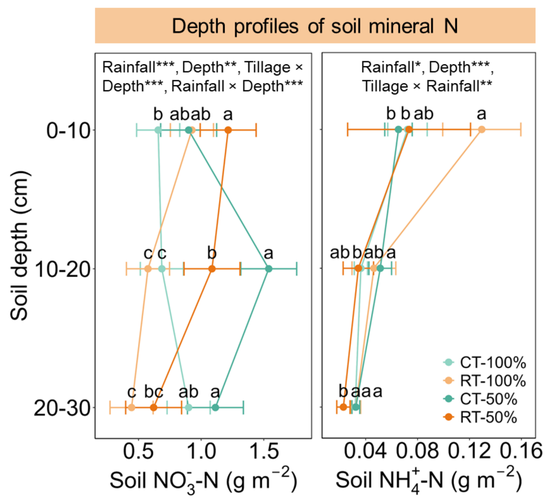


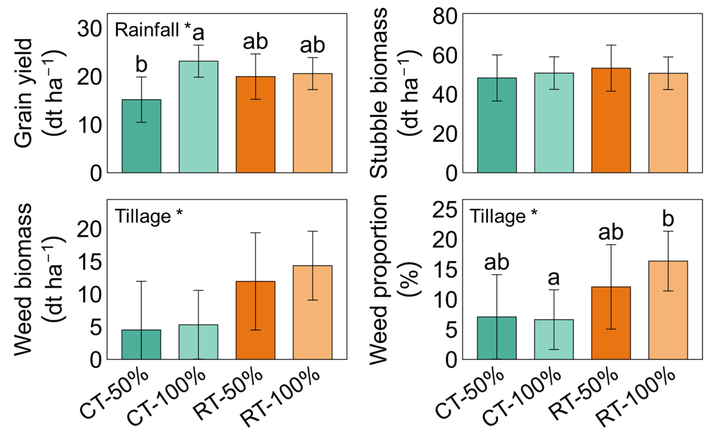
- **0-10 cm** → strongest fertilizer-induced **mineral N peaks**

CONCLUSIONS

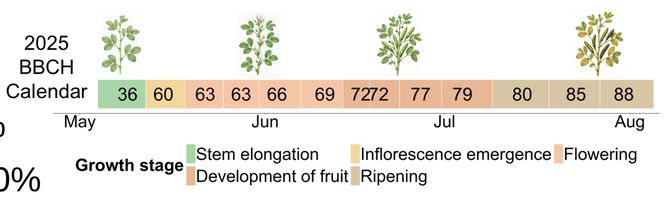
- Reduced rainfall lowered cumulative N_2O emissions under RT, while tillage and fertilization induced clear N_2O and mineral N pulses.
- Fertilizer-induced mineral N responses were strongest at 0-10 cm, while RT-100% showed higher SWC at 0-10 cm but lower SWC at 10-30 cm.
- Reduced rainfall decreased faba bean yield under CT, while RT increased weed proportion under ambient rainfall.

➢ Faba bean post-harvest responses





- **NH_4^+-N** → RT-50% < RT-100%
- CT-50% → ↓ **Faba bean yield** vs. CT-100%
- RT-100% → ↑ **Weed proportion** vs. CT-100%



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