CLIMAGROCYCLE

powered by klima+ energie fonds

BOKU

AGES

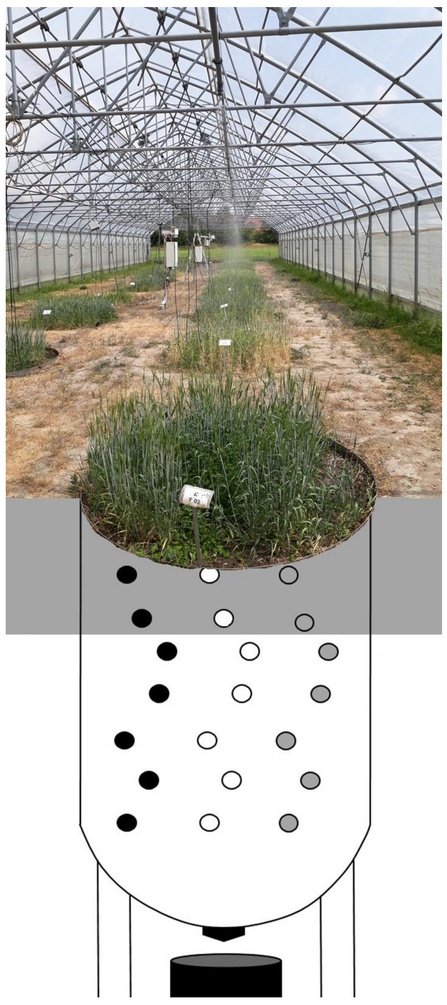
Bundesamt für Wasserwirtschaft

Consequences of climate change for agroecosystem Carbon and Nitrogen cycling

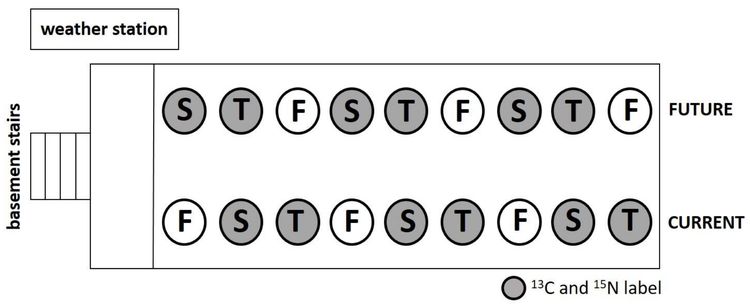
Anna Wawra[1], Andreas Baumgarten[1], Helene Berthold[1], Alexander Bruckner[3], Rebecca Hood-Nowotny[3], Johannes Hösch[1], Herbert Formayer[3], Erwin Murer[2], Johannes Wagenhofer[2], Simon Leitner[3], Andreea Spiridon[1,3], Andrea Watzinger[3] ([1]AGES – Österreichische Agentur für Gesundheit und Ernährungssicherheit, 1220 Wien; [2]BAW – Bundesamt für Wasserwirtschaft, 3252 Petzenkirchen; [3]BOKU- Universität für Bodenkultur, 1180 Wien)

INTRODUCTION

Climate change is likely to affect precipitation patterns in the future, and as such is a determining factor in agricultural systems in terms of soil organic matter mineralization, nutrient release and therefore plant production. This study investigates the impact of precipitation on different soil types of the Pannonian area in Austria. A regionalized scenario RCP 6.0 derived from the 5th IPCC was used on a long-term lysimeter study in the Marchfeld, where future rainfall patterns were compared with current precipitation since 2011.



METHODS



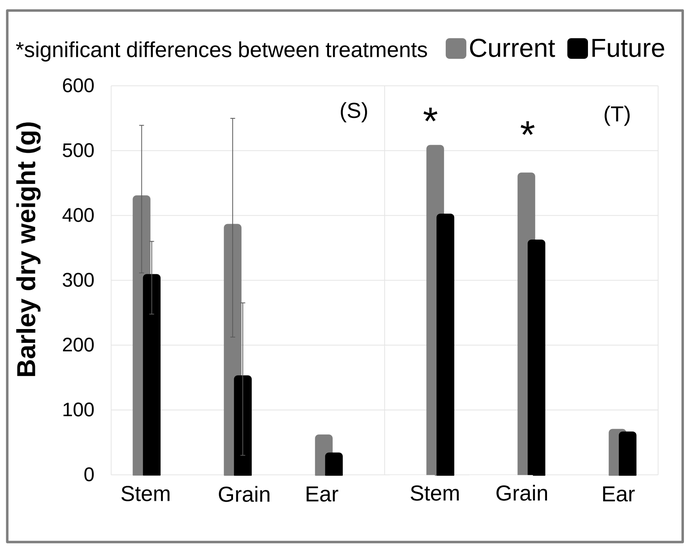
(S) sandy calcaric phaeozem
(T) calcic chernozem
(F) gleyic phaeozem

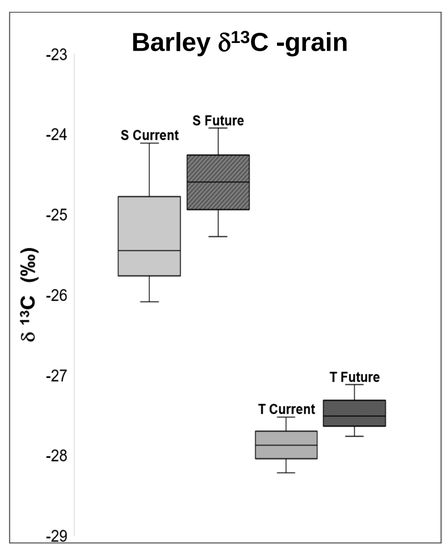
A more precise way of tracing carbon and nitrogen turnover in soils is using a stable isotope labelling approach. Green manure (*Sinapis alba*) labelled with **^{13}C and ^{15}N stable isotopes** was applied to the lysimeter soils in April 2018. Gas, soil, plant and groundwater samples were collected at different time points throughout the growing season and analysed using isotope ratio mass spectrometry (IRMS) and a cavity ring down spectrometer (CRDS) for ^{15}N N_2O installed in the field.

RESULTS & HIGHLIGHTS

CARBON CYCLING

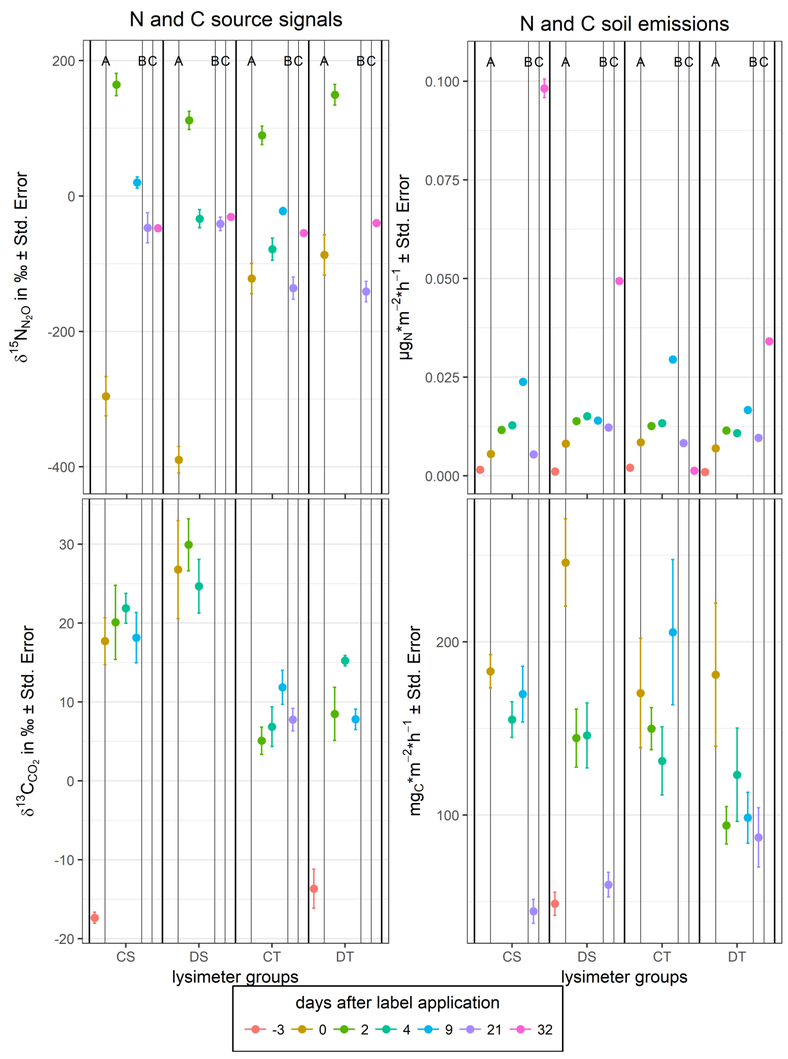
- **Plant biomass was decreased in the future scenario due to drought stress** (increased δ^{13}C values).
- Mineralisation of green manure (^{13}C CO_2) and label uptake into soil microorganisms (^{13}C PLFA) started within hours of application, whereby faster green manure mineralisation rate in S than T soil in the current precipitation regime, and less CO_2 emissions from T soil in the future scenario were found.





NITROGEN CYCLING

- Initially **slower release of inorganic N (NO_3-)** after green manure addition under the **future scenario**. However, its proportion in crops increased during summer, emphasizing the reliance of plant biomass production on root NO_3- uptake from soil.
- Emissions of N_2O were generally low, and initially slightly higher under the current precipitation scenario. Highest N_2O emissions especially in the current scenario was observed after commercial fertilizer (50 kg ha^{-1}) was added.
- A simulated **heavy rainfall event** (60 mm) **increased N_2O emissions** in the **future scenario** within a few hours with up to ten fold higher emissions.



OUTLOOK

This study demonstrates the relevance of green manure as a fertilization strategy to avoid N_2O emissions. Lower plant biomass in the future scenario led to lower mineralisation of the green manure and higher availability of inorganic N in soil which is prone to **nitrogen leaching**.

Contact person: **DI[in] Dr[in] Anna Wawra** I BGPE I Spargelfeldstr. 191, 1220 Wien
anna.wawra@ages.at
AGES – Austrian Agency for Health and Food Safety

Funded by the Austrian Climate Research Programm KR16AC0K13275