ETH zürich

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Can precision fertilization mitigate N_2O emissions from crop production?

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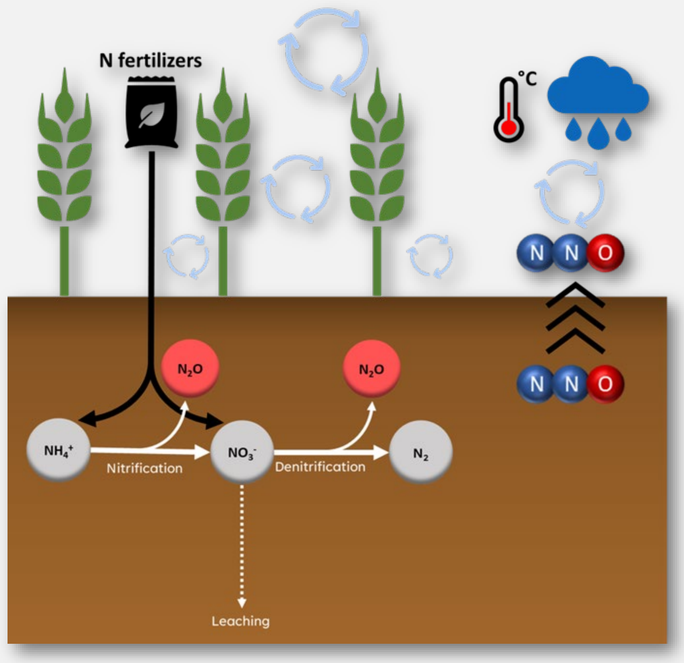
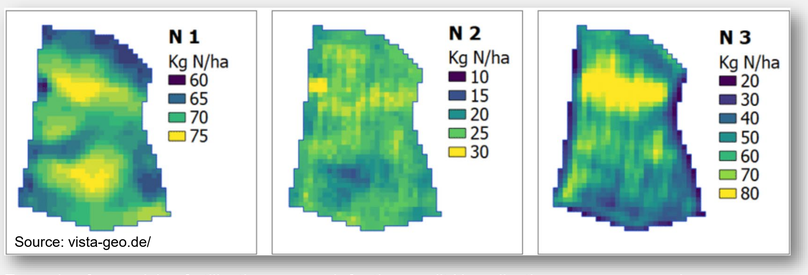
Motivation

- **Nitrous oxide** (N_2O) ranks as the third most important greenhouse gas (GHG), contributing substantially to **global warming** and climate change [1]. Nearly **70%** of all anthropogenic N_2O emissions originate **from the agricultural sector**. The primary source of these emissions lies in the soil's reaction to the **application of nitrogen (N) fertilizers** [1, 2].



- **Precision fertilization** aims to **reduce N losses** by customizing the N supply based on the crop's specific N demand. This **data-driven** approach utilizes spatial data (e.g., satellite imagery), to **fine-tune the amount of N applied** to individual sections of the field [3].



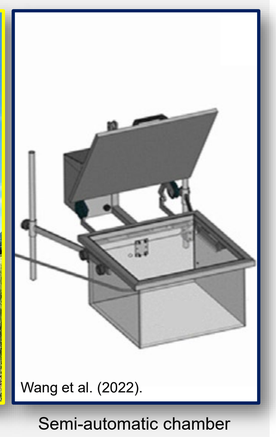
Example of a precision fertilization approach for three split N applications across a cropping season.

To what extent precision fertilization can mitigate N_2O emissions from crop production?

Methods

- The **study site** is located in Tänikon and is part of the Swiss Future Farm project.
- The field is split into two fertilization treatments: **conventional Vs variable rate application** (VRA)
- An **Eddy Covariance** (EC) station and 8 **semi-automatic chambers** are used to measure N_2O fluxes.

EC station



Semi-automatic chamber

- Additional measurements:
  - Nitrate leaching
  - Meteo (e.g., temperature, relative humidity, radiation)
  - Soil temperature and moisture
  - Soil mineral N concentration
  - Crop parameters (LAI, canopy height, N content)

Contribution to Sustainable Food Systems

- Mitigation of N_2O emissions from agriculture → **climate change mitigation**
- Optimizing N use in agriculture → **sustainable agriculture**

References

[1] IPCC, 2023. Climate Change 2021 – The Physical Science Basis: Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, 1st ed. Cambridge University Press.

[2] Mosier, A., Kroeze, C., Nevison, C., Oenema, O., Seitzinger, S., & van Cleemput, O. (1998). Closing the global N2O budget: Nitrous oxide emissions through the agricultural nitrogen cycle. Nutrient Cycling in Agroecosystems, 52(2), 225–248.

[3] Argento, F., Anken, T., Abt, F., Vogelsanger, E., Walter, A., & Liebisch, F. (2021). Site-specific nitrogen management in winter wheat supported by low-altitude remote sensing and soil data. Precision Agriculture, 22(2), 364–386.

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