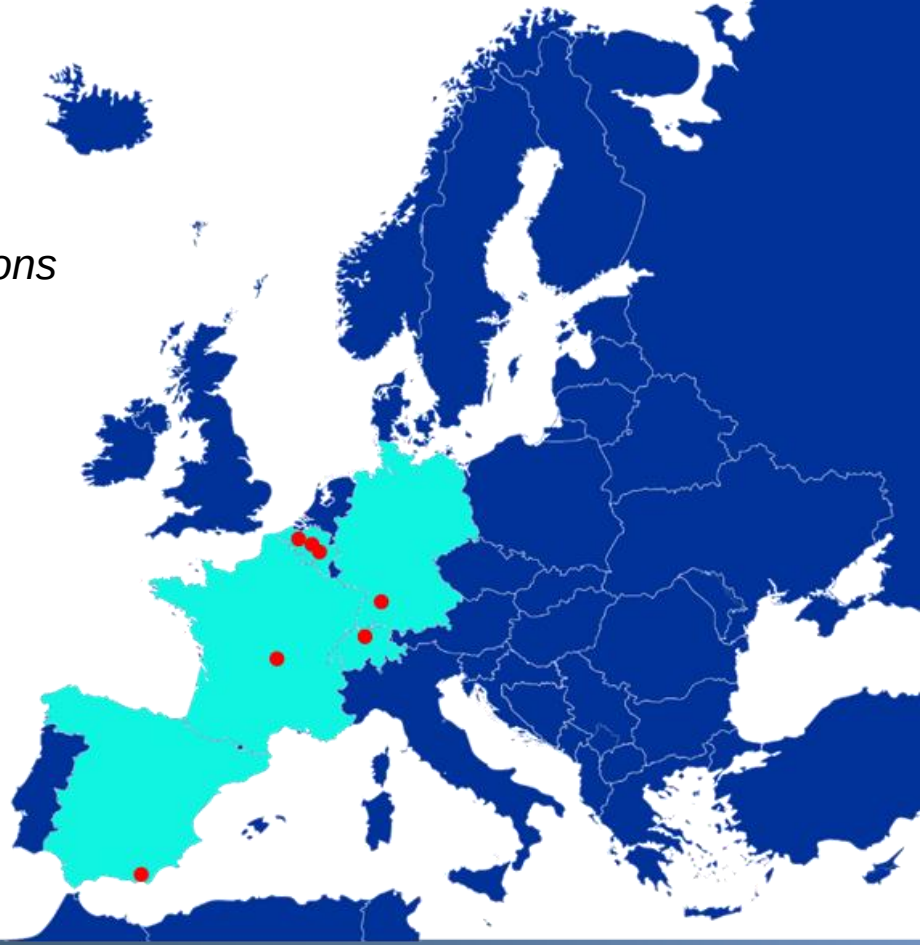
biodiversa+
European Biodiversity Partnership

BIOdiversity of soils and FArming Innovations for improved Resilience in European wheat agrosystems

BIOFAIR

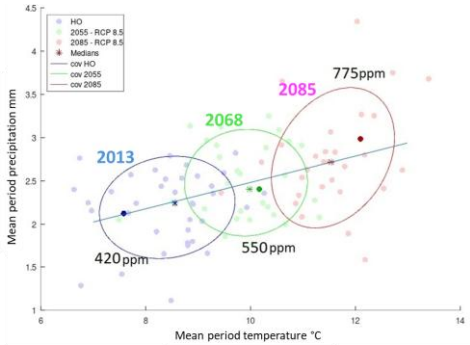


Coordinated by
Liège University and Université Libre de Bruxelles, BELGIUM

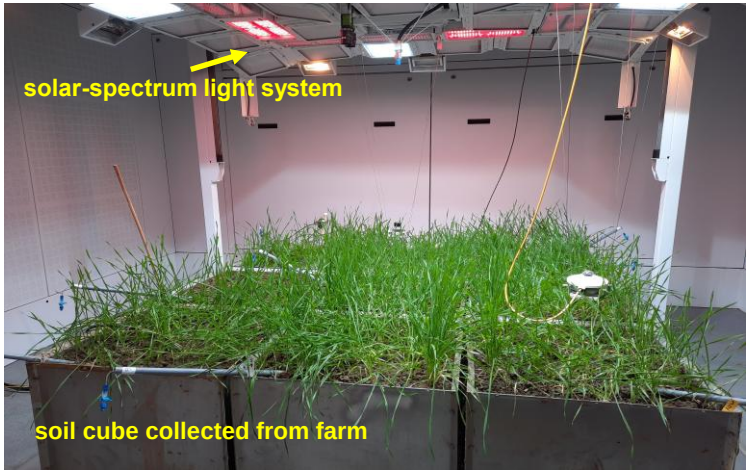
FiBL Switzerland – Frick – SWITZERLAND
FiBL Europe – Brussels – BELGIUM
Hohenheim University - Stuttgart – GERMANY
Ghent University – Ghent – BELGIUM
CSIC – Almería – SPAIN
INRAE – Clermont-Ferrand - FRANCE

Project goals and methodology

- Assessing the impacts of **climate change** and **innovative farming practices** on plant productivity, nutritional quality and fitness.
- Studying the **soil functioning** and the related soil microbiome as well as micro- and meso-fauna **biodiversity**.
- Understanding the reported changes in **productivity**, **quality** value of the cereal grains and the **suppressiveness capacity** of such soils against **(a)biotic stresses**.



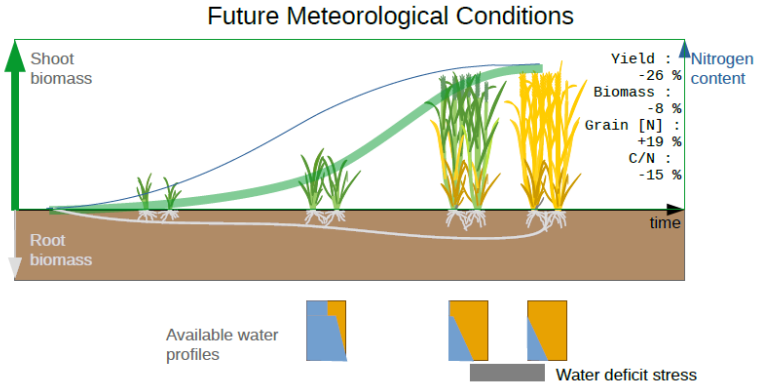
Harvest year	Mean temperature (°C)	Mean precipitation (mm)	Hydro-thermal Index (HI)
2013	7.59	2.12	3.99
2068	10.17	2.40	4.49
2085	12.10	2.98	4.74

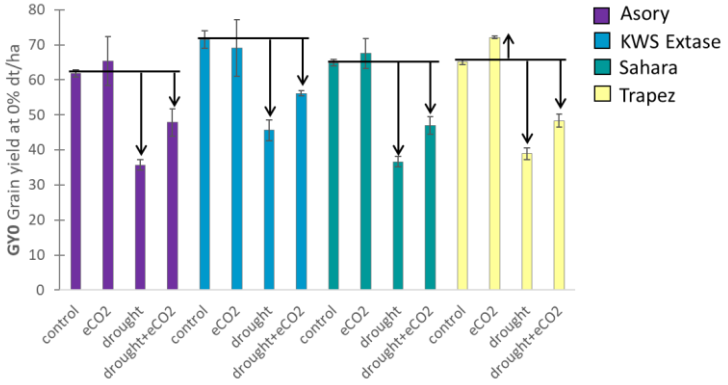


Scientific results

Impact of Climate Change (CC) on Wheat:

- Higher winter temperatures boosted biomass but reduced tillering, root development and yield.
- Elevated CO_2 (+4.1%) had minor yield benefit; impaired protein and baking quality.
- Drought significantly reduced yield (-40.4%); only partially offset by elevated CO_2.
- Climate treatments decreased gluten protein quality, altering dough strength.
- Root systems remain critical to cope with water stress.
- Recommendation: Breeding should target short-term climate scenarios and root traits.

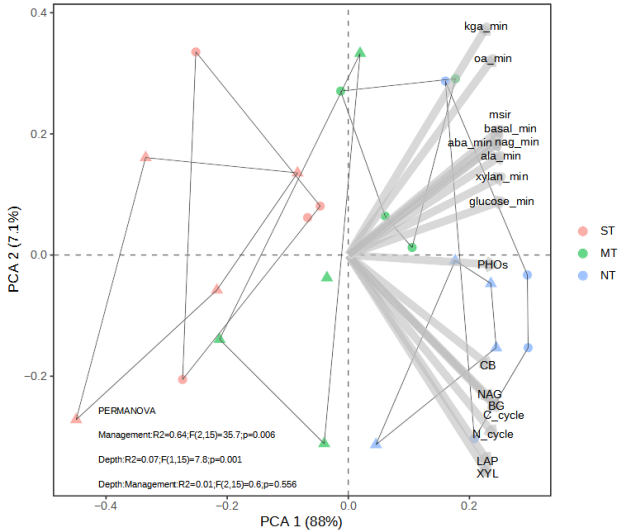


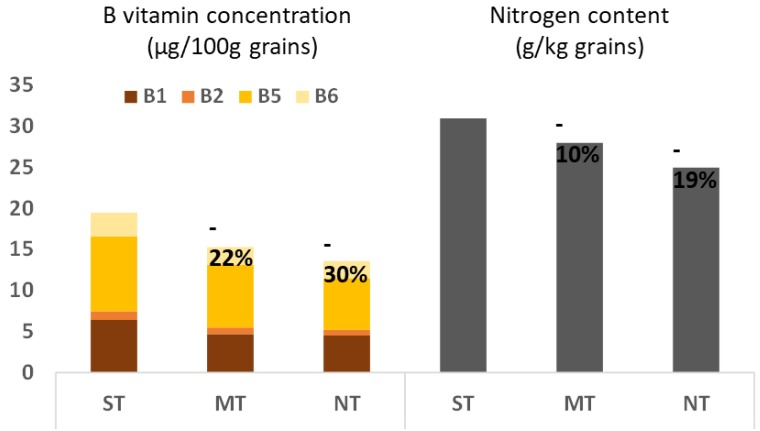


Scientific results

Farming Practices and Soil Biodiversity & Wheat:

- Tillage intensity (NT<MT<ST) shaped soil microbial and mesofauna communities.
- Reduced tillage increased microbial activity and soil functionality.
- Reduced tillage impaired wheat quality and changed technological grain properties.

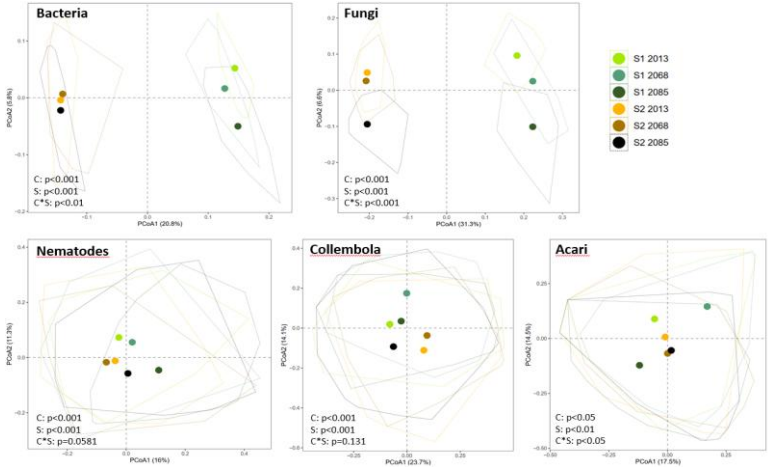


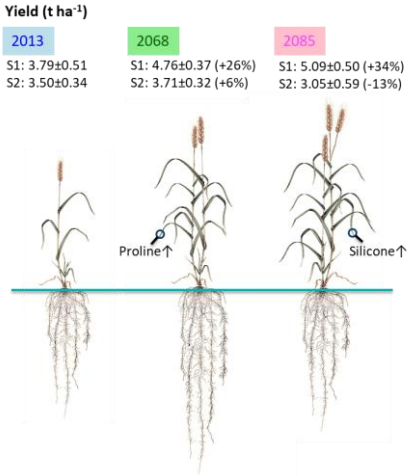


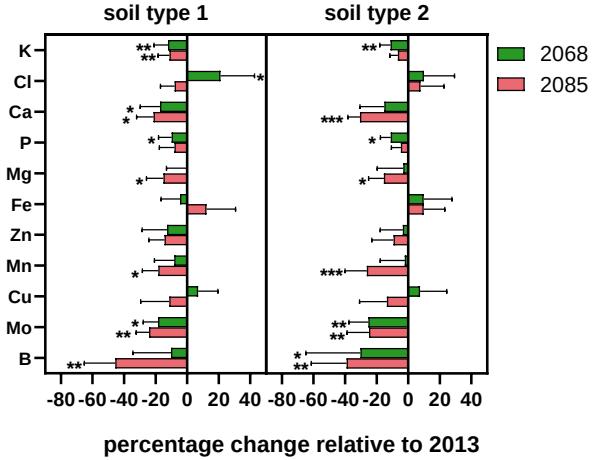
Scientific results

Resilience & Environmental Impact:

- Organic-rich soils (S2) buffered climate effects better than conventional soils (S1) - higher soil health indicators.
- This implies more stable microbial communities and improved nutrient cycling.
- The yield difference between both soils increased over time.
- Climate change negatively affects the nutritional quality of grains produced in both soil conditions.
- Recommendation: Combine biofortification, root-focused breeding, and integrated strategies.







Policy and societal impacts / results

Climate Adaptation:

- Adapt breeding programs to short-term (20-year) climate projections.
- Include extreme weather events in scenarios and policy planning.
- Adjust vernalization and sowing schedules to match future conditions.

Sustainable Agriculture:

- Reduced tillage supports soil health and biodiversity.
- Practices impact GHG emissions and nitrate leaching, important for regulation.

Nutritional Security:

- Climate change reduces grain nutrient concentration (protein, vitamins, minerals).
- Policy focus should expand to include grain quality and public health.

Research Recommendations:

- Support speed breeding and integrated modelling.
- Link biodiversity to function using 'who does what and when' approaches.
- Promote systemic approaches considering crop performance and ecosystem services.

Acknowledgements

This project is funded by:

- *FWO Research Foundation (Flanders)*
- *F.R.S. – FNRS (Wallonia)*
- *SNSF (Switzerland)*
- *ANR (France)*
- *AEI (Spain)*
- *DLR-PT (Germany)*