Biodiversity of soils and farming innovations for improved resilience of European wheat agrosystems

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BIOFAIR holistically determines **soil biodiversity** under different farming practices and environmental stressors to **anticipate negative impacts** of climate change on belowground processes and **provide adaptation strategies**. On the crop site, a specific focus is given to grain quality parameters such as **vitamin and mineral nutrient contents** essential for many human body functions, and to technological bread making properties such as flour viscosity, to ensure the crops of the future have a **high nutritious value** and are **suitable for food production.**

Climate change : What impact on crop production?

Climate change

- **Temperature**
  - Increased evapotranspiration
  - Accelerated soil mineralisation rates
  - Risk of enhanced GHG emissions
  - Proliferation of insects
  - ± phenological crop development

x

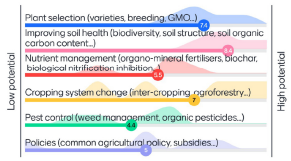
- **Carbon dioxide CO_2**
  - Higher rates of photosynthesis
  - Increased biomass production
  - Increased crop nutrient and water demand
  - Stimulation of rhizosphere microbes?

x

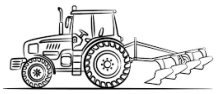
- **(Excess/Lack of) Precipitation**
  - Permanent wilting point: plant senescence
  - Waterlogging: hypoxia and root rotting
  - Proliferation of pathogens

Farming practices: How can we adapt cropping systems to environmental change?

What has the highest potential to adapt wheat production to climate change?

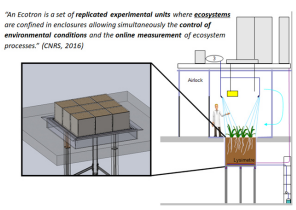


BIOFAIR uses a **co-creation** process and regularly consults a dedicated **External Stakeholder Board** (ESB).



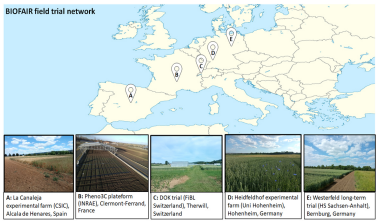
Experimental approaches: Ecotron and field trials

Ecotron experiments



- Ecosystem processes are studied in large plant-soil units to **maintain biological and physical complexity** at relevant scale.
- Climate scenarios encompass the cumulative effects of **multiple environmental stressors** related to global change.
- Several controlled environment rooms (CERs) enable study design with **independent replication**.

European long-term field trials



Currently five field sides across a pedo-climatic gradient in Southwest Europe testing

→ different fertilisation schemes (mineral nitrogen forms, organic vs mineral amendments)

→ different wheat varieties

→ tillage intensities and soil inversion

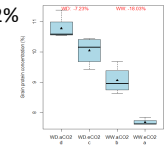
→ effect of drought via rain exclusion

→ effect of elevated CO_2-concentrations

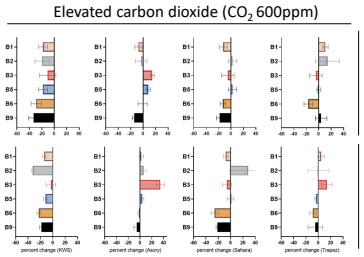
Wheat grain quality : Is the wheat of the future good for human health and suitable for bread making?

Winter wheat grains contain

- All eight **B-vitamins** that help enzymes release energy from carbohydrates and fat, aid the immune response and transport oxygen: thiamin (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), pyridoxine (B6), biotin (B7), folic acid (B9) and cobalamin (B12).
- **Mineral elements** such as iron (Fe), zinc (Zn), magnesium (Mg) and calcium (Ca).
- Around 12% **protein**



Elevated carbon dioxide (CO_2 600ppm)



Technological parameters

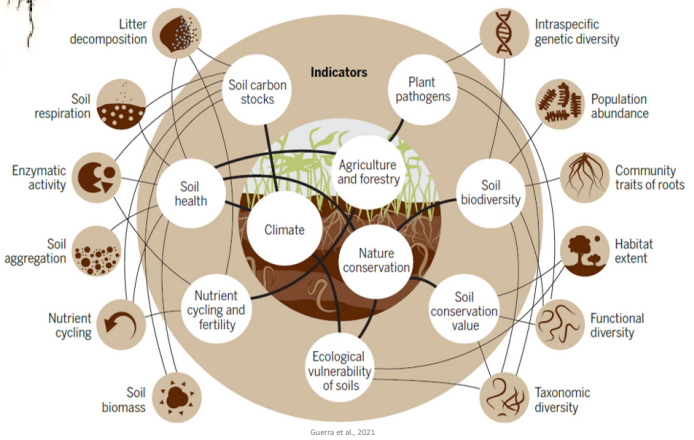
- Granule size distribution
- Alveograph Chopin
- Flour viscosity

Soil biodiversity: Which organisms maintain soil functions and how is soil life organised?

• Bacteria & fungi • Archae, protozoa, rotifera	Microorganisms
• Roundworms (nematodes)	Microfauna (< 0.2mm)
• Mites (acaria) • Springtales (collembola)	Mesofauna (< 4mm)
• Earthworms (lombrics)	Macrofauna (< 80mm)

- Community composition
- Food web complexity

Soil services: How do climate change and farming practice affect the functionality of soils?



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