SolACE

Solutions for improving **A**groecosystem and **C**rop **E**fficiency for water and nutrient use

a multi-actor project with 25 partners incl. 11 non academics

2017-2022 (1st annual meeting by Mid-May 2018)

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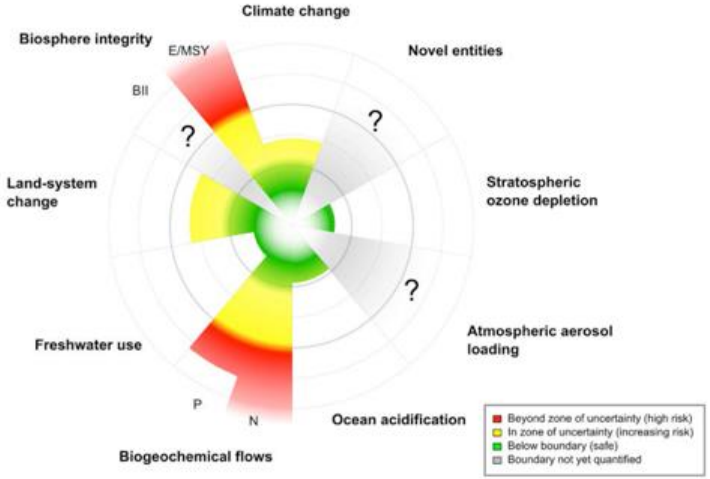
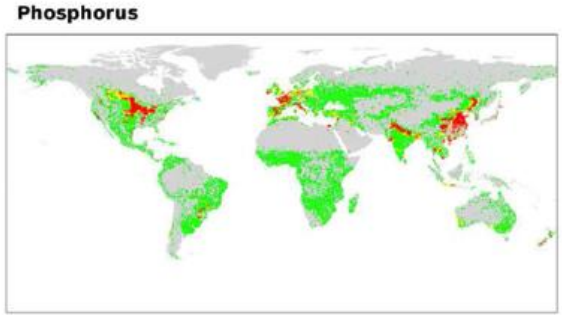
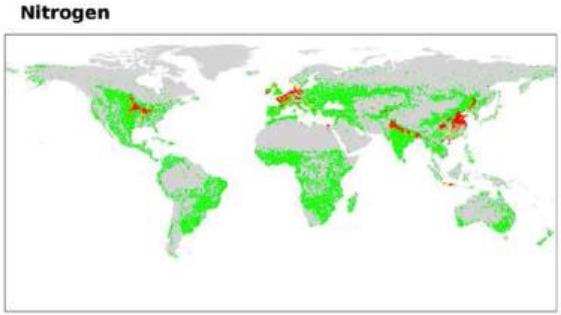
What is the problem ?

European agriculture facing global changes

Getting beyond planetary boundaries:
intensive agriculture and excess use of mineral fertilizers have resulted in major alterations of P and N biogeochemical flows
***(Rockström et al. 2009** – Nature)*
***(Steffen et al. 2015** – Science)*

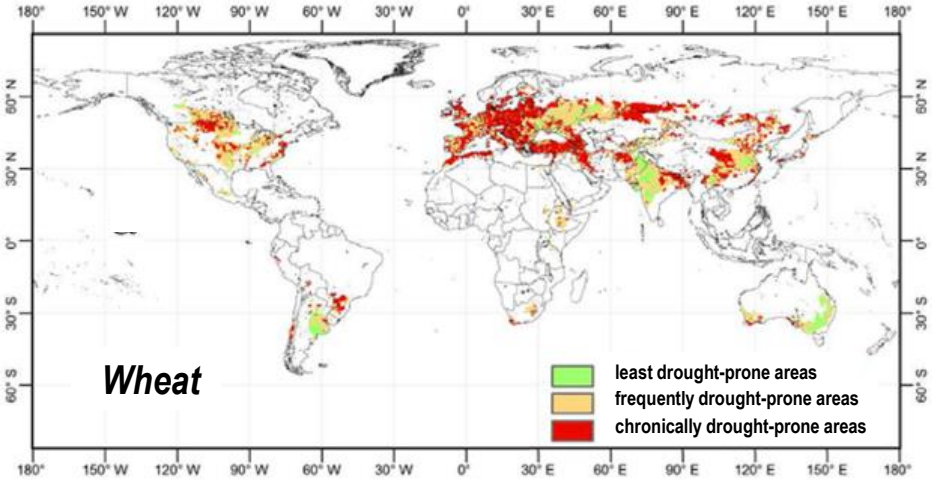






What is the problem ?

- **European agriculture facing global changes**
  (increased rainfall variability (drought) and reduced use of N and P fertilizers)
- thus **increasing occurrence of combined water (due to climate change) and N or P stresses**



***(Wang et al. 2014** – Quaternary Int. 349)*

What is the objective ?

- **design/test novel**
- **management innovations (inoculants, etc…)**

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- **innovative breeding strategies, ideotypes, genotypes (hybrids…)**
- **i.e. performances under combined stresses (drought x N or P)**

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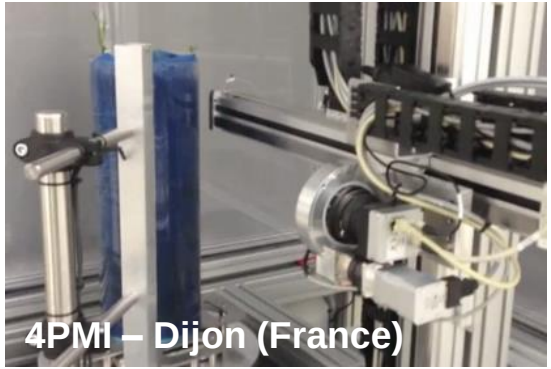
What is the approach ?

- **multi-actor approach** along two lines of innovations: **agroecological practices** and **crop genetic diversity-based solutions**

- field-relevant levels of combined stresses
- **largely relying on field (incl. on-farm) experiments** + unique phenotyping facilities (for belowground traits)



- focus on three major European crops: **bread wheat**, **durum wheat** and **potato**

What do we plan ?

- **Identify crop responses to combined stresses**,
  i.e. realistic simultaneous limitation by water and N or P availabilities

- **Evaluate resource (water, N and P) acquisition efficiency**
  and define the corresponding, relevant **below-ground traits**
  (root / rhizosphere microbiome / symbiosis)

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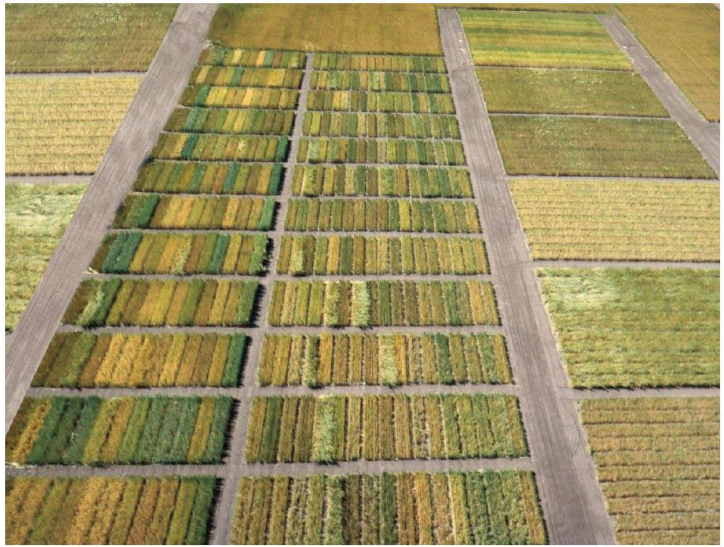
- **Identify crop responses to combined stresses**, i.e. realistic simultaneous limitation by water and N or P availabilities

- **Evaluate resource (water, N and P) acquisition efficiency** and define the corresponding, relevant **below-ground traits** (root / rhizosphere microbiome / symbiosis)

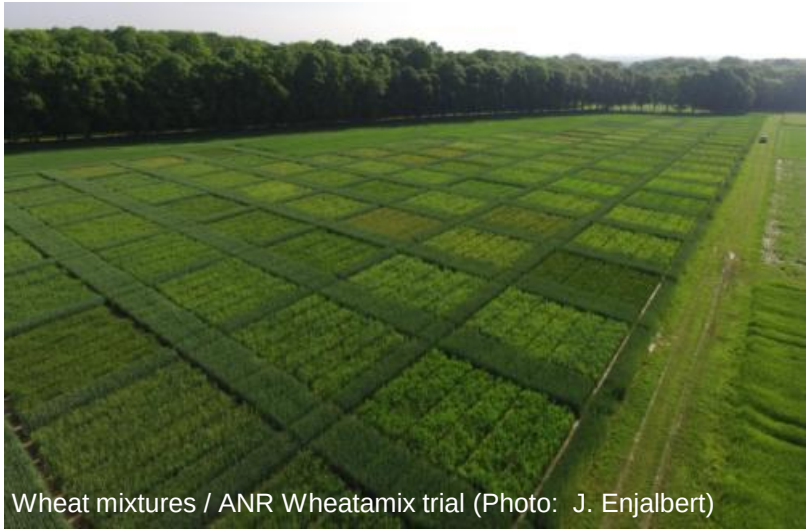
- **Identify genotypes and genes involved in combined stress response**

- **Design novel, resource efficient ideotypes or hybrids**



What do we plan ?

- **Use** *in field conditions* **biotic interactions** at play in agroecological innovations:
- **Design/evaluate efficient microbial inoculants**, as well as **their combinations**,
- **Design/evaluate efficient genotype mixtures**



Wheat mixtures / ANR Wheatamix trial (Photo: J. Enjalbert)

What do we plan ?

- **Use** *in field conditions* **biotic interactions** at play in agroecological innovations:
- **Design/evaluate efficient microbial inoculants**, as well as **their combinations**,
- **Design/evaluate efficient genotype mixtures**
- **Test crop rotation and reduced tillage/no till strategies**
- **Develop novel enabling technologies** for crop/soil monitoring and management of water and N status
- **Evaluate *on-farm* their agronomic / economic / environmental performances** *at field plot scale*

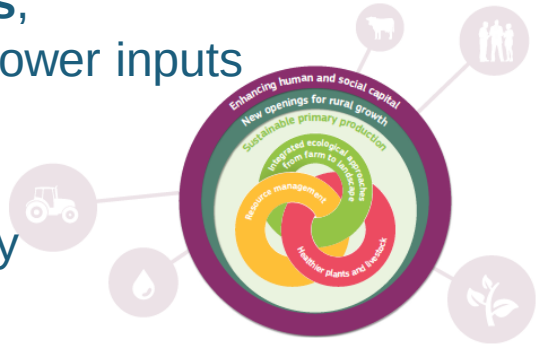
What is our contribution to the overall strategy ?

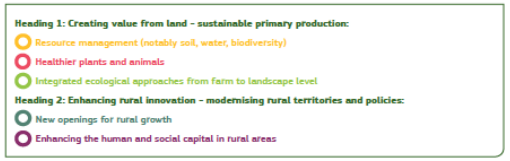
- **Creating value from land – sustainable primary production**
  Priority 1: resource management (notably soil, water, biodiversity)

- = better **coping with combined water and nutrient scarcity**

- e.g. through using more resource-efficient **crop genotypes**,
  i.e. plants which can achieve high productivity with lower inputs

- e.g. through using **agroecological innovations**,
  i.e. making use of managed and associated diversity
  - **microbial inoculants**
  - **root microbiome**
  - **crop genotype mixtures**





What are the gaps in research ?

- **Further include belowground traits**
  proper high-troughput tools for quantifying **roots traits** in field conditions

- **Further draw links with root microbiome**
  proper tools for assessing **functional microbial communities** involved

- **Further implement ecological intensification**
  testing **greater plant diversity** at the plot scale: intercropping, agroforestry

- **Foster the links with food systems (i.e. through the whole value chain)**
  co-designing innovations, e.g. for promoting **greater use of legumes**

ReMIX Species mixtures for redesigning European cropping systems

ideas INITIATIVE FOR DESIGN IN AGRIFOOD SYSTEMS