From sensors to crop science

- ✓ A field platform with controlled environments and environmental sensors
- ✓ High capacity for housing large genotype panels
- ✓ A unique suite of validated and novel sensors
- ✓ A fully implemented data analysis pipeline
- ✓ Tailored protocols and research programs

Our implication in major R&D projects

Constructing PhénoField® is a strategic decision of the French Cereal and Maize growers' boards that manage ARVALIS - Institut du végétal, the technical institute which mutualizes R&D for French farmers. The platform is supported by the French government via the «Investissements d'Avenir» program, as part of the PHENOME (French Plant Phenotyping Network) project.

PHENOME

As a platform of the Phenome network, PhénoField® is a key element for the development and validation of novel field phenotyping techniques.

AMAIZING project

In 2015 and 2017, PhénoField® will house a historic series of maize hybrids from France to evaluate the genetic progress in drought response and the physiological traits underpinning it.

BREEDWHEAT Project

In 2016 and 2018, PhénoField® will welcome the BreedWheat association genetics panel representing the last 25 years of wheat breeding in France. This trial will provide insight into the genetic and physiological architecture of drought response in French wheats.

Localisation

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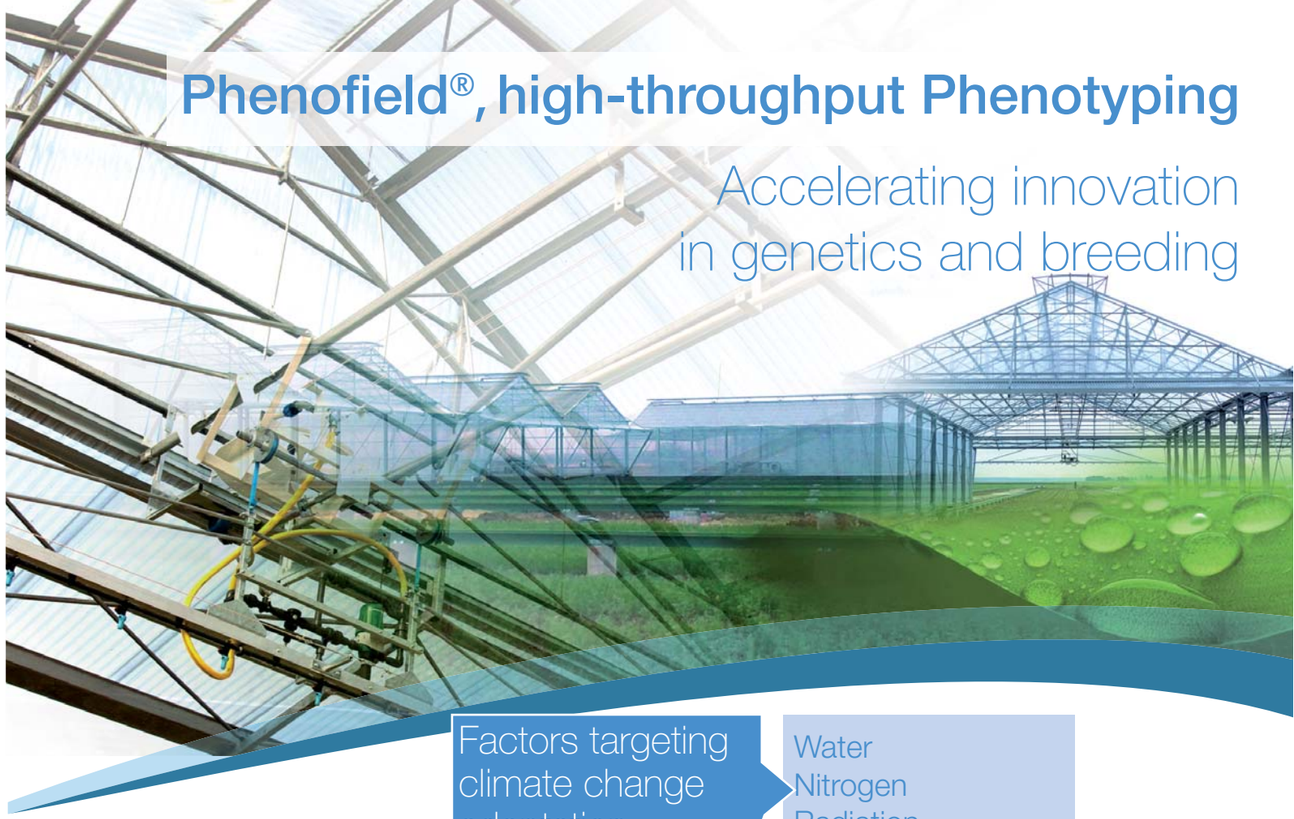


Phenofield®, high-throughput Phenotyping

Accelerating innovation in genetics and breeding

PhénoField®

Factors targeting climate change adaptation
- Water
- Nitrogen
- Radiation

Multiple sensors and know-how
- Environment and soil water sensors
- Plant canopy sensors

Diversity of species
- Short straw cereals
- Maize
- Other field crops

Research targets : What questions can we answer ?

PhénoField A platform for deep characterization of germplasm
My elite/breeding line seems great for drought : what's the physiology behind its performance ?

PhénoField A tool for quantitative genetics
What is the genetic architecture of my panel's response to drought ?

PhénoField A technology evaluation platform
Is my sensor relevant and precise for screening genotypes responses ?

ARVALIS Institut du végétal

PHENOME Réseau Français Phénomique végétale FPPN — INRA SCIENCE & IMPACT — ANR — GIS bV

Available tools at PhénoField®

PhénoField® infrastructure

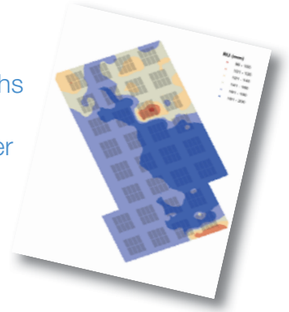
> **8** mobile rain-out shelters
> **5 000 m²** of sheltered trialing capacity
> **384** sheltered microplots
> **384** rainfed microplots
> Up to **350** genotypes
> **16** irrigation carts
> Up to **17** different irrigation regimes

Environmental characterization

Weather and soir description to increase heritability

Weather
> Overall site meteorology
> Microplot scale micrometeorology

Soil water
> 1000 observations of soil horizon depths and pedological analyses
> Microplot level estimations of Soil Water Holding Capacity
> 8 tensiometers
> TDR sensors (fixed and mobile)
> NIR sensors



High-throughput Canopy dynamics

Faster, more frequent non-destructive measurements

Crop Canopy

8 phenotyping gurneys equipped with :
> 2 LIDARs, 6 Cameras, 4 spectroradiometers
> And more to come

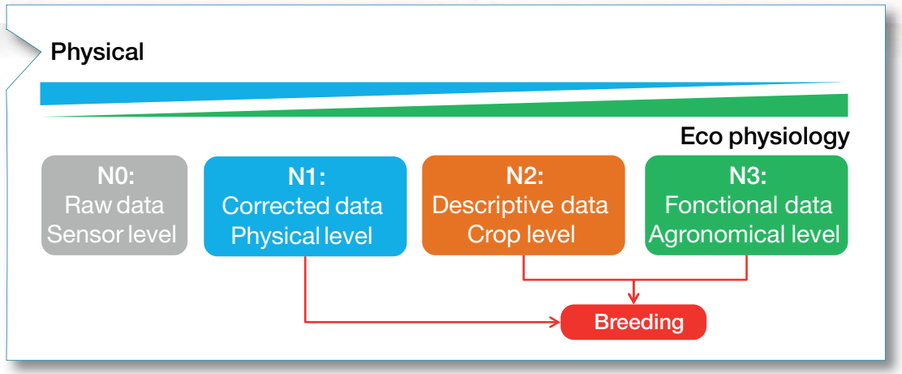
1 hexacopter drone
> High resolution multispectral and thermal imaging

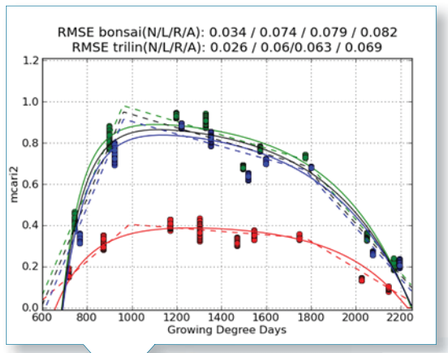
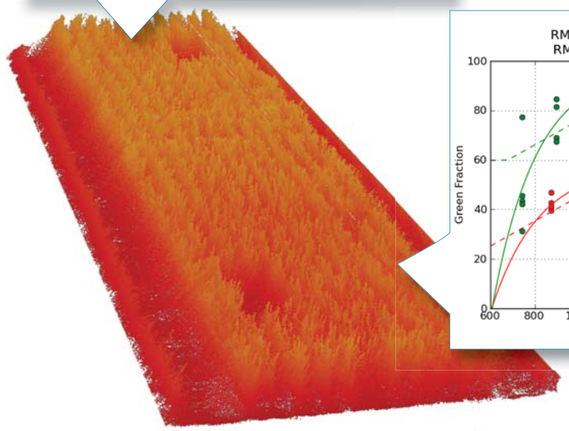
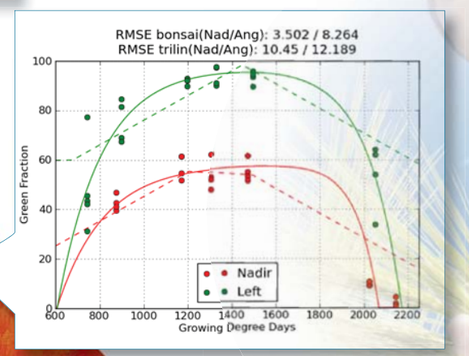
Standardized measurement methodologies
One measurement every 100 degree days, i.e. up to 20 points per cropping cycle

A wealth of scientific and technical know-how

Around PhénoField®, an ecosystem of expert researchers in agronomy, crop physiology robotics, biophysics, bio-informatics make it possible to :

> Cultivate the major field crop species properly in the platform
> Propose adapted experimental designs
> Control and calibrate sensors
> Analyze and interpret sensor data to provide physiological/agronomic indicators
> Connect environmental, soil and plant canopy data
> Model the relations between plant and environmental factors to extract complex traits
…





To date, we provide frequent, rapid, non-destructive measurements of:
> Canopy architecture
> Leaf area expansive growth
> Senescence
> Radiation Use Efficiency (RUE)
> Water Use Efficiency (WUE)
…