RÉPUBLIQUE FRANÇAISE
Liberté Égalité Fraternité

INRAE

PlantRBA

EXPLORATORY PROJECT

2021-2023

Predicting plant phenotypes under combined stress

Coordination
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Key words
High-throughput phenotyping
Combined abiotic stress
Genotype-phenotype relationship
Resource allocation
Constraint-based models
Plant systems biology

INRAE units involved
MaIAGE

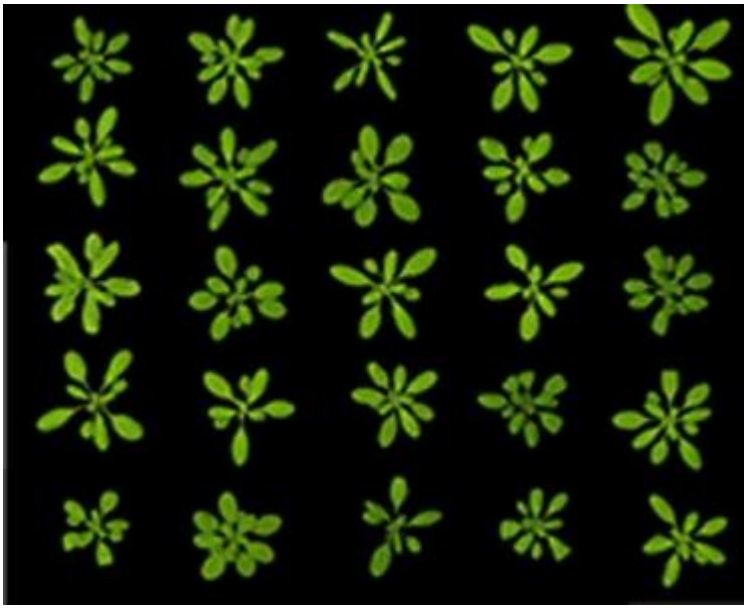
Partnerships
IJPB

Context and challenges

Climate change, the scarcity of certain natural resources and the need to reduce agricultural inputs have increased the number and diversity of situations that agronomists need to understand.

They need plant models with extensive predictive capability and capable of taking into account complex environmental conditions, where different constraints (stresses) come into play at the same time.

Well-established plant models at the individual level, such as the ecophysiological models they usually use, generally fail to cope with such realistic conditions. Indeed, the cellular scales, i.e. the scales where adaptation occurs, are poorly described in these models. The challenge of this project is therefore to refine the description of cellular and sub-cellular scales in plant modelling (and more generally in the modelling of multicellular organisms) and thus better link the genotype and phenotype of an organism.



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Goals

This project aims to develop, calibrate and experimentally validate a mathematical model predicting the behaviour of the *Arabidopsis thaliana* plant under abiotic constraints (limited water and/or nitrogen availability). This model is based on the parsimonious distribution of resources between the different biological functions of the plant and thus reconciles the smallest scales (genes) with the phenotype.

The project combines cutting-edge mathematical models in plant modelling with state-of-the-art experimental techniques designed to grow plants under the most robust environmental conditions, on the Phenoscope platform, to generate very high-quality biological data for model calibration and validation.

Research units involved and partnerships

INRAE scientific division	INRAE research units	Expertises
Mathematics, computer and data sciences, digital technologies	MaIAGE	Modelling, systems biology, omics data analysis and integration, bioinformatics
External partners		**Expertises**
IJPB Institut Jean-Pierre Bourgin		Phenotyping, physiology, bioinformatics, genetics

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