RÉPUBLIQUE FRANÇAISE
Liberté Égalité Fraternité

INRAE

IFM2A2

SCIENTIFIC NETWORK

2021-2022

Building a new approach to integrate the functioning of apical meristems in the dynamic modelling of plant aerial architecture

Coordination

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Key words

Aerial morphogenesis
Apical meristem
Self-centred model
Plant architecture
Physical constraints
Genetic variability

INRAE units involved

URP3F
IRHS
LEPSE
PIAF
IJPB
AGAP Institut
MIAT

Partnerships

Inria

Context and challenges

The use of a greater diversity of plant species to optimise natural resources has highlighted the need for a better understanding of the dynamics of plant stands. Competition for light between individuals is a key phenomenon in these dynamics. This is why the simulation of aerial architecture is essential. This is essentially determined by the functioning of the apical meristems of the different axes of the plant, which includes the production of apexes (branching), the production of leaves and the elongation of the axes, up to the formation of fruits and their positioning in the stand.

Recent work by INRAE and INRIA on this topic has been the subject of high-impact publications. However, a better understanding of the determinants of aerial morphogenesis in response to the environment requires a new and multidisciplinary approach, in order to take into account different levels of scale, from the gene to the stand.

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Metaprogramme
DIGIT-BIO

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Goals

The IFM2A2 consortium proposes to bring together in a sustainable manner the different scientific communities that are currently working separately on simulating the functioning of apical meristems at different scales, operating in different INRAE departments (BAP, MAthNum and AgroEoSystem) in close interaction with INRIA.

In order to achieve such syntheses, which allow science to move from the subcellular or cellular scales to those of the organ and the plant in the stand, it is essential to build a space for sharing and exchanging information between scientific communities from different disciplines, thanks to effective communication tools.

With a view to bringing these different communities together, the consortium calls for:

- The organisation of an international seminar (28-30 November 2022 in Poitiers);
- The joint writing of a multi-scale synthesis journal;
- The construction of a sustainable animation network, in order to accelerate the production of models integrating the different scales.

Research units involved and partnerships

INRAE scientific division	INRAE research units	Expertises
Agronomy and environmental sciences for agroecosystems	URP3F	Plant ecophysiology: conducts a programme of architectural modelling of plants in ecophysiology
	IRHS	Plant biology: studies the genetic and environmental control of meristem branching activity
	LEPSE	Dynamic simulation of aerial morphogenesis. Individual-centred modelling of plant-environmental stress interaction
	PIAF	Study of the biomechanical determinants of plant growth
Plant biology and breeding	IJPB	Physiology of the primary wall. Develops plant biology programmes on primary wall synthesis and branching
	AGAP Institut	Simulation mathématique de la morphogenèse des apex
Mathematics, computer and data sciences, digital technologies	MIAT	Mathematical simulation of apex morphogenesis.
External partners		**Expertises**
Inria	Équipe projet MOSAIC	Mathematics and plant biology: modelling of plant morphogenesis and apical meristem function

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