Genome Harvest - Mobilizing biomathematics/bioinformatics and genomics/genetics to decipher genome organization and dynamics as pathways to crop improvement

OBJECTIFS

Nuclear magnetic resonance (NMR) is increasingly applied to the study of plant cells, plant tissues, organs, and living plants as a whole. Today, dynamic MRI functional imaging offers exciting new opportunities for physiological mapping of whole plants at high spatial and temporal resolution. Understanding plant physiology at this level should answer many unanswered questions about plant productivity, development, and stress responses and open up unparalleled new avenues for understanding the relationships between plant growth, productivity, stress tolerance, and competitiveness.
The overall objective of the APLIM project was to federate an interdisciplinary community to develop new tools (NMR and MRI) to non-destructively measure fluxes in plants and to better understand plant response to abiotic and biotic stresses to accelerate research and innovation.

ACTIONS

A first part was dedicated to the "development of innovative NMR and MRI tools and methods dedicated to plant research in the laboratory, greenhouse and field". The configuration of the NMR/MRI experimental facilities was adapted to model plants (Arabidopsis, tomato, rice) and to a wide variety of crops by designing optimized NMR coils and sensors. A transportable NMR relaxometer was also built for field studies on crops. The design and synthesis of novel chemical nano-objects as innovative contrast agents to track water and molecular dynamics in plants addressed the concept of "smart nanoprobes."
The second part focused on NMR spectroscopy, relaxometry and imaging to study plant responses to biotic and abiotic stresses. The first objective was to take advantage of existing tools and available NMR/MRI technologies to overcome the limitations of current approaches in plant physiology. The second objective was to conduct new technological developments to address unresolved questions related to transport in intact plant architecture under controlled and field conditions.

RESULTATS

The project has led to the creation of an NMR and MRI imaging platform adapted to plants, unique in France, thanks to the development of an original methodology for quantifying the fluxes measured by innovative patented tools (antennas) and associated with software adapted to MRI image processing.

Responsable :

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