agropolis fondation

Genome Harvest

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

ABSTRACT

Le projet découle d'une série de « success story » de la communauté Montpelliéraine dans la production de séquences de référence du génome de plantes cultivées et dans la description de leurs caractéristiques. Couplé à cela, l'arrivée des outils de séquençage à haut débit permet d'envisager une meilleure compréhension de l'organisation et des dynamiques de ces génomes, éléments clés pour une meilleure exploitation de leur diversité dans les programmes de sélection. Cependant, un certain nombre de verrous méthodologiques sont encore à lever du point de vue des concepts, méthodes et outils en bioinformatiques /biomathématiques.
L'objectif du projet est de développer des modèles, méthodes et outils qui permettront de répondre à ces enjeux et plus spécifiquement de s'intéresser aux évènements fréquents d'hybridation inter(sub)spécifique qui sont observés dans l'histoire des plantes cultivées et cela au travers d'un certain nombre de cas d'études. La force du projet réside entre autre dans la diversité des espèces étudiées (citrus, banane, riz, café, tomate, arachide, sucre de canne). Un objectif sous-jacent est de rassembler des scientifiques des différents domaines autour de ces questions (mathématiciens, bioinformaticiens, généticiens, …). La dissémination des nouveaux outils et méthodes se fera à travers des sessions de formation destinées aux membres et partenaires du projet et aux scientifiques du Sud.

Keywords : Developing the plant of the future, Plant, Genomics, Bioinformatic, Genetic structure, Coffee, Rice, Tomato, Citrus, Banana

Year : 2015
Project number : 1504-006
Type of funding : PE
Project type : PC
Research units in the network : DIADE IPME-PHIM GAFL
Start date : 2016-01-15
End date : 2019-10-15
Flagship project : no

Project leader : Angelique D'hont
Project leader's institution : CIRAD
Project leader's RU : AGAP

Budget allocated : 500000 €
Total budget allocated (including co-financing) : 700000 €
Funding : Labex

GOAL

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.

ACTION

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.

RESULTS

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.