

## THE UNIVERSITY OF REIMS CHAMPAGNE-ARDENNE

has recognized skills and know-how that are essential to **plant production**, whether agricultural, viticultural or horticultural. Our technical resources and scientific skills in this domain enable us to find solutions to guide and improve farming practices by combining precision, quality, yield and environmental protection.

### Expertise in plant production

#### Soil fertility and soil-air interactions

- Soil management (see specific sheet)
- Biodegradation of plant biomass in soils (crop residues, roots, by-products, mulch), composting, retting
- Stabilisation of carbon in the soil
- Mineralisation and recycling of mineral nitrogen
- Greenhouse gas emissions (N<sub>2</sub>O, CO<sub>2</sub>)
- Functional features of microbial communities
- Agricultural management of plant biomass and ecosystem services
- Coupling of carbon and nitrogen cycles
- Statistics: indicators and typology of organic matter degradation
- Environmental impact (VOC / GHG emissions, eutrophication) of spreading methanisation digestates on cultivated land
- Transfer of phytosanitary products into soils

#### Plant immunity and biocontrol

- Multi-scale characterisation of plant immunity (molecular, biochemical, cell, tissue, organism)
- Impact of biotic and abiotic stress on plant immunity (defence / resistance mechanisms)
- Identification of specific markers and signalling pathways for defence and resistance in plants
- Biocontrol, elicitation, biological control, antibiosis

#### Viticulture

- Study of fungal diseases in vines (wood diseases, mildew, grey rot, etc).
  - Mechanisms of action of pathogens and plant defence mechanisms
  - Impact of environmental factors on the development of diseases
  - Biocontrol of diseases
- Study of the transfer of organic and mineral pollutants in wine-growing areas
- Optimised performance of innovative retention basins in wine-growing areas

#### Digital technology for agriculture

- Multi- and hyperspectral imaging
- Semi- and weakly supervised hierarchical and dynamic classification
- On-board detection algorithms
- Sensor networks, machinery, automation, image capture (caterpillar tractors, self-driving vehicles, drones)
- Precision agriculture and viticulture: detection of weeds, diseases, water stress, varieties, input requirements, monitoring of crop development, yield prediction
- Data Mining, Machine Learning, Deep Learning
- High-performance computing

## 4 MAIN RESEARCH AREAS

- Plant immunity and biocontrol
- Soil fertility and soil-air interactions
- Viticulture
- Smart agriculture

## KEY FIGURES



**65** Researchers and teacher-researchers



**4** patents

**+ than 25** industrial collaborations



**15** European projects obtained in the past 5 years

**6** laboratories \*

\* USC INRAE 1488 Résistance Induite et Bio-protection des Plantes (RIBP) - Chaire « Maladies du bois de la vigne » (MALDIVE)  
EA 3804 Centre de Recherche en Sciences et Technologie de l'Information et de la Communication (CReSTIC)  
UMR 614 URCA/INRAE Fractionnement des Agro-Ressources et Environnement (FARE)  
EA 3795 Groupe d'Etude sur les Géomatériaux et Environnements Naturels Anthropiques et Archéologiques (GEGENAA)  
UMR 7312 URCA/CNRS Institut de Chimie Moléculaire de Reims (ICMR)  
UMR 7331 URCA/CNRS Groupe de Spectrométrie Moléculaire et Atmosphérique (GSMA)  
Centre de Calcul de Champagne-Ardenne [ROMEO](#), RNSR 201923174L

## For applications in



Agriculture



Environment



Agronomy



Healthcare



Viticulture



Biocontrol

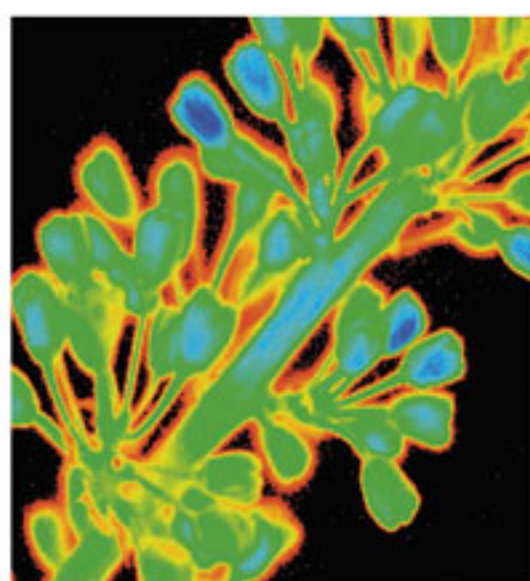


Horticulture



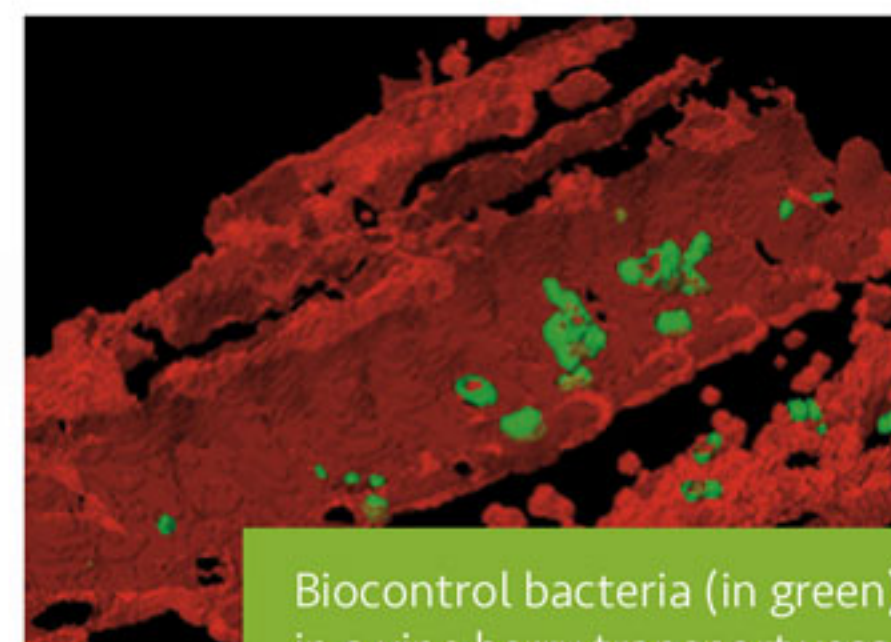


## State-of-the-art equipment at the service of our researchers and industry network



### Plant immunity and biocontrol / Viticulture

- Photosynthesis: gas exchange, photosystems, LICOR, chlorophyll fluorescence, 3D imaging PAM
- Phenotyping of biocontrol solutions: greenhouses (160m), experimental vineyard (150 plants), climatic chambers, in vitro culture
- Molecular biology and microbiology: qRT-PCR, Nanodrop, sequencing, collection of biocontrol agents (microorganisms, elicitors)
- Microscopy: fluorescence, phase contrast, 3D microscope



Biocontrol bacteria (in green) in a vine berry transport vessel (in red)



### Soil fertility

- Environmental test chambers and rainfall simulators
- Elemental and soluble C and N analysers
- Gas analysers (N<sub>2</sub>O, CO<sub>2</sub>), and automated sampling device
- Laboratory for Stable Isotope Analysis (LADIS) (12C / 13C, 14N / 15N)
- Biochemical analyses of plants
- Enzyme analyses of soils
- Fluorescence, UV-visible, IR spectrophotometers



Installation of instrumented plots in the field



### Digital technology for agriculture

- Sensors
- Embedded systems
- Drones
- High Performance Computing (HPC - ROMEO)
- Handheld spectrometers (MIR, NIR)
- Digital imaging and simulation centre: immersive UHD (4K) and interactive 3D modelling and visualization



Data Science & Machine Learning at the service of viticulture

## Some publications

- Kutschera, A. *et al.* Bacterial medium-chain 3-hydroxy fatty acid metabolites trigger immunity in *Arabidopsis* plants. *Science* 364, 178 (2019).
- Lashermes, G., Gainvors-Claissé, A., Recous, S. & Bertrand, I. Enzymatic Strategies and Carbon Use Efficiency of a Litter-Decomposing Fungus Grown on Maize Leaves, Stems, and Roots. *Frontiers in Microbiology* 7, 1315 (2016).
- Sauvadet, M. *et al.* High carbon use efficiency and low priming effect promote soil C stabilization under reduced tillage. *Soil Biology and Biochemistry* 123, 64–73 (2018).

## Quality training courses

### Initial training

Are you looking for future collaborators? Do you wish to complete your studies? A wide range of quality training courses provided at URCA focus on plant production.

To find out more: [www.univ-reims.fr](http://www.univ-reims.fr)

### Vocational training

Does your structure / company wish to support its employees by training them in plant production?

Our experts can help you. URCA's vocational training department is ready to meet with you to study your needs and offer you the most appropriate training solution.

To find out more: [dfpa@univ-reims.fr](mailto:dfpa@univ-reims.fr)

### Contact :

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