



objectif  
végétal

Research, Education and Innovation  
in PAYS de la LOIRE



RESEARCH  
EDUCATION  
INNOVATION

in Pays  
de la Loire  
FRENCH REGION

# PLANT HEALTH AND QUALITY RESEARCH CENTRE IN PAYS DE LA LOIRE-FRENCH REGION

The right partner for research collaboration

Campus du  
végétal



Since September 2015, most of the horticulture and seed research forces are located in the new **Angers Plant Science Campus**: **24,8 million euros** of investments for **8,400 m<sup>2</sup>** of laboratories and offices, **6900 m<sup>2</sup>** of greenhouses and growth chambers (S1, S2, S3) and a new building housing the international French cluster **VEGEPOLYS VALLEY** and **Plante&Cité**, the national center for landscape and urban horticulture.



## THIS DOCUMENT PRESENTS THE RESEARCH AREAS OF THE FOLLOWING INSTITUTIONS:

### **AGROCAMPUS QUEST**

Institute for Life, Food and Horticultural Sciences and Landscaping

A public scientific, cultural and professional institution under the authority of the Ministry of Agriculture. A triple vocation:

- training students to a high scientific level,
- conducting academic and applied research based on the sustainable development of resources and territories,
- transferring knowledge to socio-economic sectors.

### **ANSES**

French Agency for Food, Environmental and Occupational Health & Safety

Plant health laboratory – Bacteriology, Virology, GMO's detection Unit. In the area of plant health, ANSES undertakes risk analyses, vigilance and alert missions for harmful organisms. As a national reference laboratory, it carries out research projects for developing detection methods of plant pests, and organizes interlaboratory comparison and proficiency tests.

### **ESA**

Ecole Supérieure d'Agricultures

An institute of higher education and research for life sciences, under the authority of the French Ministry of Agriculture. A wide range of courses in 10 major sectors of activity over 50 different programs from undergraduate to PhD level: agriculture, agronomy and food sciences, landscape planning, environment, horticulture, viticulture, retailing, trade, agribusiness management.

### **GEVES**

A French official organisation with extensive expertise on seeds and plants across the majority of cultivated botanical species. GEVES evaluates varieties for their registration in the national list or for legal protection (plant variety rights), and is the National Reference Laboratory in France for seed quality analysis. GEVES is also responsible for the national coordination of plant genetic resources for the Ministry of Agriculture.

### **INRA**

INRA is the largest agricultural research institute in Europe and is the second-largest producer of agricultural science publications. INRA contributes to development of knowledge and innovation in the fields of food, agriculture and the environment.

The INRA Pays de la Loire research centre has built its identity on the sustainable management of healthy farming, sustainable processing of agricultural bio-resources and the health and nutritional quality of food. These areas are key issues for human health.

### **UNIVERSITY OF ANGERS**

Built on a very long history of universities in the city, the University of Angers is made up of 7 Faculties, Schools and Institutes and is committed to seeking continual improvement in student success, teaching methods and research, relying on new technologies.

Research at the University of Angers is transversal and multidisciplinary. It is organised into 5 research departments (Plant and environment sciences, Medical sciences, Materials sciences, Mathematics and computer, Humanities and social sciences) and 5 federative structures whose missions are the scientific animation and the coordination of shared resources.

850 researchers in 25 units, including 13 joint research units accredited by major French research organisations (CNRS, INSERM, INRA),

520 PhD students (40% are foreigners).

### **UNIVERSITY OF NANTES**

Major higher education and research centre in Western France, is one of the rare French universities to promote interdisciplinarity.

38,000 students mix within the 20 faculties and schools. 295 specialities are represented, 44 laboratories work in all fields of knowledge.

All of them are gathered within the regional program **Objectif Végétal - Research, Education, Innovation in Pays de la Loire**, and members of the international French cluster **VEGEPOLYS**.

# A REAL DYNAMIC FOR RESEARCH, EDUCATION AND INNOVATION

## THE FEDERATIVE RESEARCH STRUCTURE ON PLANT QUALITY AND HEALTH «SFR QUASAV»

400 people in 9 research and experimental units

### IRHS

**Research Institute on Horticulture and Seeds**

Horticultural crops quality

Plant Health

Seed quality

<https://www6.angers-nantes.inra.fr/irhs>



### LBPV

**Laboratory of plant biology and pathology**

(Determinism of plant parasitism and host resistance)

<https://sciences-techniques.univ-nantes.fr/recherche/ea-1157>



UNIVERSITÉ DE NANTES

### LEVA

**Legumes, Crop Ecophysiology, Agroecology**

<http://www.groupe-esa.com/en/recherche>



### GRAPPE

**Agro-food products and processes**

<http://www.groupe-esa.com/en/recherche>



### SIFCIR

**Functional Signalling of Ion Channels**

**and Receptors** (mode of action of insecticides, optimization of insecticide efficacy)

<http://www.angers-nantes.inra.fr/Les-unites/SIFCIR>



### SONAS

**Substances of natural origin**

**and structural analogs**

(Chemical characterization of plant products)

<http://www.univ-angers.fr>



### EPHOr

**Physical Environment of Horticultural Plants**

<http://ephor.agrocampus-ouest.fr>



### LSV-BVO

**Bacteriology - Virology - GMOs**

<https://www.anses.fr/en/content/plant-health-laboratory>



### HORTI

**Experimental unit for horticulture**

<http://www.angers-nantes.inra.fr/Les-unites/HORTI>



### GEVES

**Variety and Seed Study and Control Group**

<https://www.geves.fr>



### VEGEPOLYS VALLEY

**Research & Development Centre**

<https://www.vegepolys.eu/en/the-rd-centre-for-plants>



# THE FEDERATIVE RESEARCH STRUCTURE ON PLANT QUALITY AND HEALTH

## «SFR QUASAV»

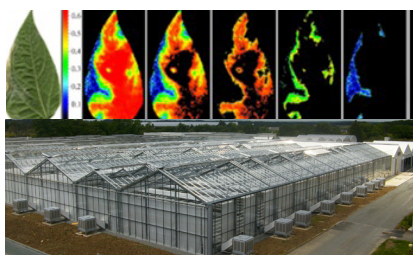
### Cross disciplinary scientific animation

#### 3 shared-access technical facilities:

cellular imaging, genomics, collection of microorganisms

#### 3 technological platforms, open to private companies

- PIAM-Phyto: phytochemical analyses
- PHENOTIC phenotyping of plants and seeds: proposes original tools and skills for fine characterization of plant-pathogen interactions, seed germination and plant development. The platform is a core facility of the European Phenotyping Infrastructure Emphasis and the European Plant phenotyping network (EPPN2020).



- SENSO'VEG: sensometric analyses



#### 3 Genetic Resource Centres

IRHS hosts 3 centres :

- plant associated bacteria
- pome-fruits, roses
- edible Apiaceae

GEVES is in charge of the national coordination of plant genetic resources conservation

#### Strong involvement in training

- 26 teaching programs for 1250 students
- **Plant Health and Quality Summer School in Angers.**

With 2700 students, **Angers** is the first **French hub for training dedicated to plants.**

### In the heart of a major European horticultural and seed production basin in the « Pays de la Loire » region

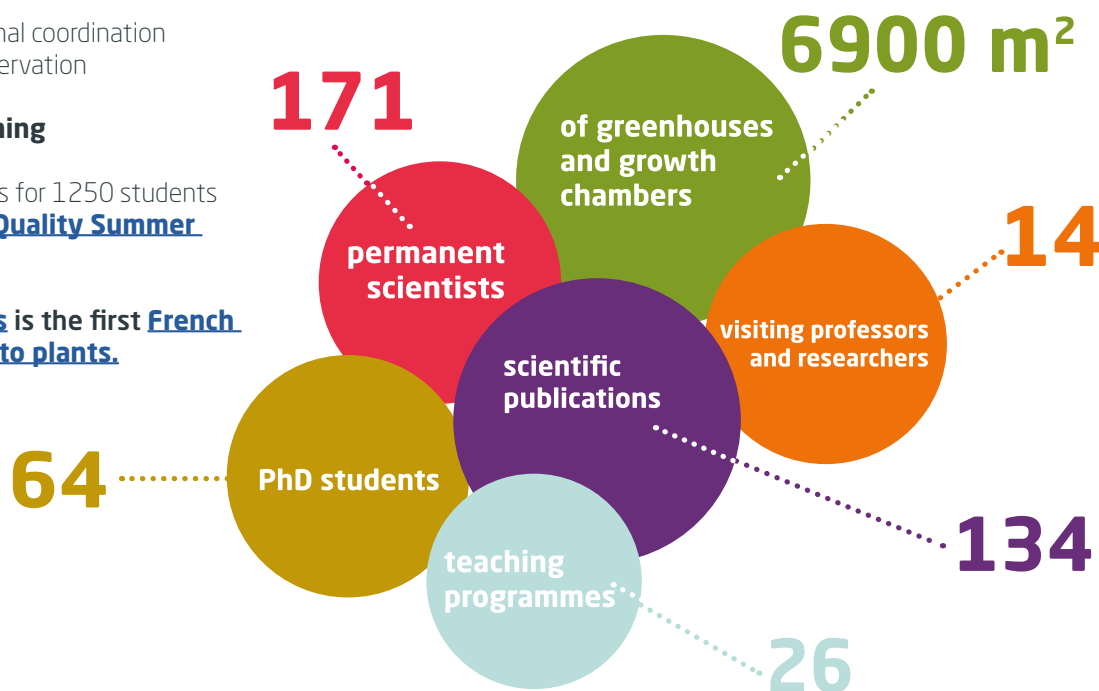
- 4000 companies representing 30000 jobs, among which leader companies such as Agrauxine (Lesaffre), André Briant jeunes plants nursery, CESBRON, CMF, Détriché, Ernest Turc, Fleuron d'Anjou, HM Clause (Limagrain), Minier, Océane, PremierTech Horticulture, Richel, Syngenta, Terrena, Vergers d'Anjou, Vilmorin-Mikado (Limagrain), Technisem.
- Several experimental institutes and trade unions.

**Members of VEGEPOLYS VALLEY**, a competitiveness cluster gathering together firms, research and training centres in the plant field around some innovative projects to strengthen the firms' competitiveness.

VEGEPOLYS has merged with CEREALES VALLEE - NUTRAVITA (based in Auvergne-Rhone Alpes). Therefore, a Global Plant Cluster having its headquarters in Angers was created on June 28th 2019 and gathers 520 members. It represents 750 labeled projects, for a total of € 2.2 billion in R & D investment.

**Members of the « Objectif Végétal regional program »** which aims to reinforce the visibility and attractiveness of basic research, to increase the attractiveness of the education Centre, to boost translational research and reinforce the processes of economic valorization of research findings.

### Key figures - 2018



# 3 RESEARCH PRIORITY AREAS IN HORTICULTURE AND SEED PRODUCTION

Fruits & vegetables, roses & ornamentals, seeds, pathogens



**Sustainable management of plant health:** genetic diversity and breeding, resistance mechanisms, evolutionary ecology of pathogens, nitrogen use efficiency, insecticides, environmental evaluation of cropping systems by Life cycle analysis.

**Seed biology, quality and health:** conservation and germination, seed borne diseases, seed tolerance to biotic and abiotic stresses.

**Quality of specialty crops:** architecture and flowering, soil-plant-climate interactions, fruit texture and conservation, genetic and physiological basis of plant quality, phytochemistry, sensorial analysis, sensory preferences of the consumers.

## Innovative approaches and research topics:

- High-throughput phenotyping (phenomics),
- Epigenetics and (epi)genomics,
- Metagenomics, metabolomics
- Modelling, big data,
- Integration of plants into urban and peri-urban areas.

50 new projects every year

## A SELECTION OF KEY PROJECTS

### **INVITE** (2019-2024) Innovation in plant variety testing in Europe

is a H2020 funded project gathering 29 public & private partners and coordinated by [IRHS](#). INVITE will focus on seven main crops: wheat, maize, sunflower, Ray-Grass, apple, tomato and potato.

The project aims at improving efficiency of variety testing and availability of information to stakeholders on variety performance under diversified production conditions and on biotic and abiotic stresses. It addresses DUS (Distinctness, Uniformity and Stability) and performance testing in a balanced way and intends to maximize synergies between them through related activities based on phenotyping, genotyping, modelling and database management.

**Contact:** [francois.laurens@inra.fr](mailto:francois.laurens@inra.fr)



### **ISOSEED** (2019 – 2023) Isotopic and metabolomic biomarkers for seed quality

ISOSEED is a project funded via the scheme "Connect Talent" by the Region Pays de la Loire (PdL) and Angers Loire Metropole (ALM).

Crop yield not only depends on mature plant performance (such as photosynthesis, nitrogen assimilation, resistance against pathogens...) but also on seed quality, from seed development to germination and seedling establishment. ISOSEED aims to explore the possibility of using broad-spectrum metabolomic and isotopic analyzes to screen crops of agronomic interest for which quality indicators are available. In particular, this involves examining the potential of using natural isotopic abundances. The research work will take advantage of the expertise of [Guillaume Tcherkez](#) ([Australian National University](#)) who joins the UMR [IRHS](#) in the project. With ISOSEED, the regional centre will reinforce its leading position in stable isotopes biochemistry.

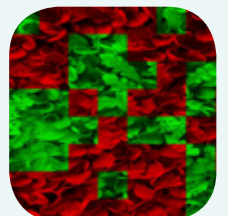
**Contact:** [guillaume.tcherkez@anu.edu.au](mailto:guillaume.tcherkez@anu.edu.au)

### **PACINP** (2017 – 2021) Phenotic As Actor of the National Phenotyping Infrastructure

Is a project funded via the scheme "Connect Talent" by the Region Pays de la Loire (PdL) and Angers Loire Metropole (ALM).

PACINP gathers scientists from Plant Sciences and Technologies of Information and Communication to build a research pluridisciplinary team dedicated to the development of methods adapted to High Throughput Plant Phenotyping with imaging and computer vision. Current topics of interest include the use of deep learning methods for the detection of developmental stages of plants, the segmentation of plant diseases, or the recognition of adventices from crop.

**Contact:** [david.rousseau@univ-angers.fr](mailto:david.rousseau@univ-angers.fr)





### **DiverIMPACTS** (2017 – 2022)

is a H2020 funded project gathering 34 public & private partners. DiverIMPACTS supports innovation actors, from farmers to consumers, in their dynamic development of sustainable agricultural systems. It aims at **diversification of cropping systems** through **rotation, intercropping, multiple cropping** promoted by actors and value chains towards sustainability.

**Contact:** [g.hellou@groupe-esa.com](mailto:g.hellou@groupe-esa.com)

### **EUCLEG** (2017 – 2021)

is a H2020 funded project coordinated by INRA, bringing together 38 public & private partners to increase EU's and China's protein self-sufficiency. EUCLEG aims to identify and develop the best genetic resources, phenotyping methods and molecular tools to **breed legume varieties** with improved performance under **biotic and abiotic stresses** in the representative European and Chinese agro-ecological areas. **IRHS** will contribute by **phenotyping** seed and seedling performance related to **crop establishment**.

**Contact:** [julia.buitink@inra.fr](mailto:julia.buitink@inra.fr)



© Olivier Leprince



### **Friendly Fruit** (2018-2021)

A demonstrator project funded by EIT Climate-KIC & CSA Booster gathering 17 public & private partners, coordinated by **IRHS**.

The project aims to identify, organize and set up the appropriate structure in the long term to define, test, implement & promote environment-friendly agricultural practices in various regions in the fruit industry. It also aims to **empower farmers with key knowledge** so they can make a practical step change towards **more sustainable farming and adaptation to Climate Change**. Strawberry and apple fruit production will be used as a test case.

**Contact:** [francois.laurens@inra.fr](mailto:francois.laurens@inra.fr)

### **GENOME\_ROSE & Rosascent** (2016 - 2020)

In the framework of an international consortium (10 teams) coordinated by IRHS and funded by INRA and Region Pays de la Loire, a high quality sequence of Rosa chinensis 'Old Blush' has been obtained (Hibrand- Saint Oyant et al; 2018, Nature Plants) and the genetic determinism of important ornamental traits as double flower has been elucidated.

ROSASCENT -ANR\* funded project- aims to explore an alternative route to produce scent in rose by employing an enzyme (RhNUDX1) of a completely unexpected family.

**Contact:** [fabrice.foucher@inra.fr](mailto:fabrice.foucher@inra.fr)



© : INRA N. Mansion



### **GENIUS** (2012-2019)

(Genome ENgineering Improvement for Useful plants of a Sustainable agriculture) – an ANR\* funded project gathering a consortium of 15 public & private partners.

Its aim is to provide French researchers and plant breeders with state of the art know-how and the biological material for **precise genome modifications** in a variety of crop species, laying the basis for high throughput functional genomics and efficient plant breeding. At **IRHS**, the work is focused on **apple** and on **rose**, to increase transformation efficiency and precision.

**Contact:** [elisabeth.chevreau@inra.fr](mailto:elisabeth.chevreau@inra.fr)



© INRA Elisabeth Chevreau

### **LABCOM FEEDINTECH** (2017-2020)

An ANR\* funded project with the aim to develop a joint laboratory between **SONAS** (Research Unit of Angers University) and **NorFeed** (French company producing natural additives for livestock feed). Seeking to develop deeper understanding of **precision animal nutrition**, the LabCom will focus on characterization and quantification of molecules inside plant-based additives, studying mechanisms of action and biological modelling.

**Contact:** [david.guilet@univ-angers.fr](mailto:david.guilet@univ-angers.fr)



### **miPEPiTO** (2017-2019)

An ANR\* funded project gathering a consortium of 4 public & private partners. Its aim is to develop and use micropeptides (miPEPs) as natural molecules to **modulate specific gene expression** (without genetic transformation or mutation) both in the parasite and in the host plant for the **biocontrol of Orobanche, Phelipanche, and Striga parasitism**.

**Contact:** [philippe.delavault@univ-nantes.fr](mailto:philippe.delavault@univ-nantes.fr)



Sunflowers infected by O. cumana



### **XF-ACTORS** (2016 – 2020)

is a **multidisciplinary** H2020 funded project gathering 29 partners. It is the first research project in Europe entirely devoted to the bacterium ***Xylella fastidiosa***. The main objective is to accomplish researches and innovation actions to improve the **prevention, early detection and control** of *Xylella fastidiosa* under different phytosanitary conditions.

**Contact:** [marie-agnes.jacques@inra.fr](mailto:marie-agnes.jacques@inra.fr)

### **Nature 4 Cities** (2016-2020)

The objective of this H2020 funded project is to structure and to develop an **interactive platform for urban actors**, by proposing databases, decision tools and evaluation tools for **nature based solutions settlement** in urban areas.

**Contact:** [patrice.cannavo@agrocampus-ouest.fr](mailto:patrice.cannavo@agrocampus-ouest.fr)



Agrocampus Ouest  
V. Le Clerc

### **OPTIMA** (2018-2022)

is a H2020 funded project gathering 15 public & private partners.

It will develop optimised Integrated Pest Management framework for vineyards, apple orchards and carrots by providing a holistic integrated approach which includes all critical aspects related to integrated disease management, such as novel bio-PPPs use, disease prediction models, spectral early disease detection systems and precision spraying techniques. At IRHS, the **QuaRVeg** team will evaluate the effects of biocontrol products on *Alternaria dauci* and the receptivity of different carrot genotypes to these products with transcriptomic and metabolomic approach.

**Contact:** [valerie.leclerc@agrocampus-ouest.fr](mailto:valerie.leclerc@agrocampus-ouest.fr)

### **VitiSmart** (2016-2019)

is a project funded by the ERA-Net Co-fund FACCE SURPLUS gathering 25 public & private partners. The project aims to produce a **resilient viticultural system** able to speedily recover from biotic and abiotic stresses. This will be achieved by combining resilient cultivars with beneficial microorganism to acquire a natural cross tolerance while maintaining yield.

**Contact:** [c.mauray@groupe-esa.com](mailto:c.mauray@groupe-esa.com)



Crédit : esa-71305\_CAzimuts (4) ©



### **UMT STRATège** (2017-2021)

is a **multidisciplinary** project funded by the French Ministry of Agriculture and Food gathering 9 public and private partners, among them ASTREDHOR, the French Technical Institute of Horticulture. It aims at revitalizing the horticultural sector by promoting the **adaptation of the horticultural products** to the **urban market**. New **technical and marketing strategies** will be further designed and evaluated in order to help professionals to adapt to these market opportunities.

**Contact:** [allan.maignant@astredhor.fr](mailto:allan.maignant@astredhor.fr) ; [philippe.morel-chevillet@inra.fr](mailto:philippe.morel-chevillet@inra.fr)

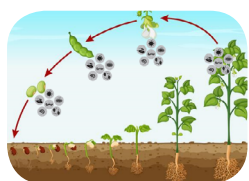
### **LabCom MATCH** (2019-2022)

An ANR\* funded project with the aim to develop a joint laboratory between **IRHS** and **Hortensias France Production** (**HFP** - the leading Hydrangea company in France). The LabCom will focus on the research of Alternative Methods to Chemical Treatments on Hydrangea with 3 research axes: alternatives to fungicides, to dwarfing molecules and adjustment of autumnal fertilization and of aluminium sulphate (blueing agent) inputs.

**Contact:** [nathalie.leduc@univ-angers.fr](mailto:nathalie.leduc@univ-angers.fr)



Crédit : H Roman



### **SEEDS** (2017-2020)

An ANR\* funded project conducted by Matthieu Barret (**IRHS**) in collaboration with Vilmorin (seed company), the University of Berkeley and supported by the Phytobiomes initiative. Its main objective is to investigate the ecological processes involved in assembly of the microbiota during seed development. Data generated will increase the understanding of the factors driving assembly of the seed microbiota that is a first step for using seed as a vector of plant beneficial micro-organisms.

**Contact :** [matthieu.barret@inra.fr](mailto:matthieu.barret@inra.fr)

ANR\* : The French National Research Agency

You want to develop research projects, you're interested in joining the Plant Health and Quality research centre in Pays de la Loire?  
a single point of contact to help you get in touch with the right expert:  
**[tanegmart.redjala@univ-angers.fr](mailto:tanegmart.redjala@univ-angers.fr)**

## CALENDAR

### OF EVENTS HELD in the Region

**GREENSYS 2019** - International Symposium on Advanced Technologies and Management for Innovative Greenhouses. Angers  
**June 16-20 2019**

**Summer School Plant Health and Quality**. Angers  
**June 24 - July 13 2019**

**1st Chenin blanc International Congress**. Angers  
**July 1-3 2019**

**Salon du végétal**. Nantes  
**September 10 - 12 2019**

**Lab Open Days at GEVES**. Angers  
**September 19-20 2019**

**Les réserves carbonées chez les ligneux**. Angers  
**October 23-25 2019**

**International asparagus days**. Angers  
**October 29-30 2019**

**#Esaconnect**, connected agriculture meeting. Angers  
**November 21 2019**

**Cereals Day at GEVES**. Angers  
**December 10 2019**

**SIVAL ANGERS: Plant production trade show**.

**VEGEPOLYS GIS Fruit Symposium: impacts of climate change on fruit production**.

**VEGEPOLYS International Business Event - BtoB meeting**.  
**January 14-16 2020**

**IHC 2022** - 31st International Horticulture Congress. Angers  
**August 14-20 2022**



## CONTACTS



[www.agrocampus-ouest.fr](http://www.agrocampus-ouest.fr)



[www.anses.fr](http://www.anses.fr)



[www.groupe-esa.com](http://www.groupe-esa.com)



[www.geves.fr](http://www.geves.fr)



[www.angers-nantes.inra.fr](http://www.angers-nantes.inra.fr)



[www.univ-angers.fr](http://www.univ-angers.fr)



UNIVERSITÉ DE NANTES

[www.univ-nantes.fr](http://www.univ-nantes.fr)



[www.vegepolys.eu](http://www.vegepolys.eu)

This document was produced as part of the activities of the regional program « **Objectif Végétal** »  
Research, Education, Innovation in Pays de la Loire, French region, in partnership with:



THIS PROJECT IS CO-FUNDED  
BY THE EUROPEAN REGIONAL DEVELOPMENT FUND