

Exchange event between the European  
phenomic community and industry

# Introduction

**EPPN<sup>2020</sup> and Phenome Emphasis fr**

Francois Tardieu (INRAE Montpellier)

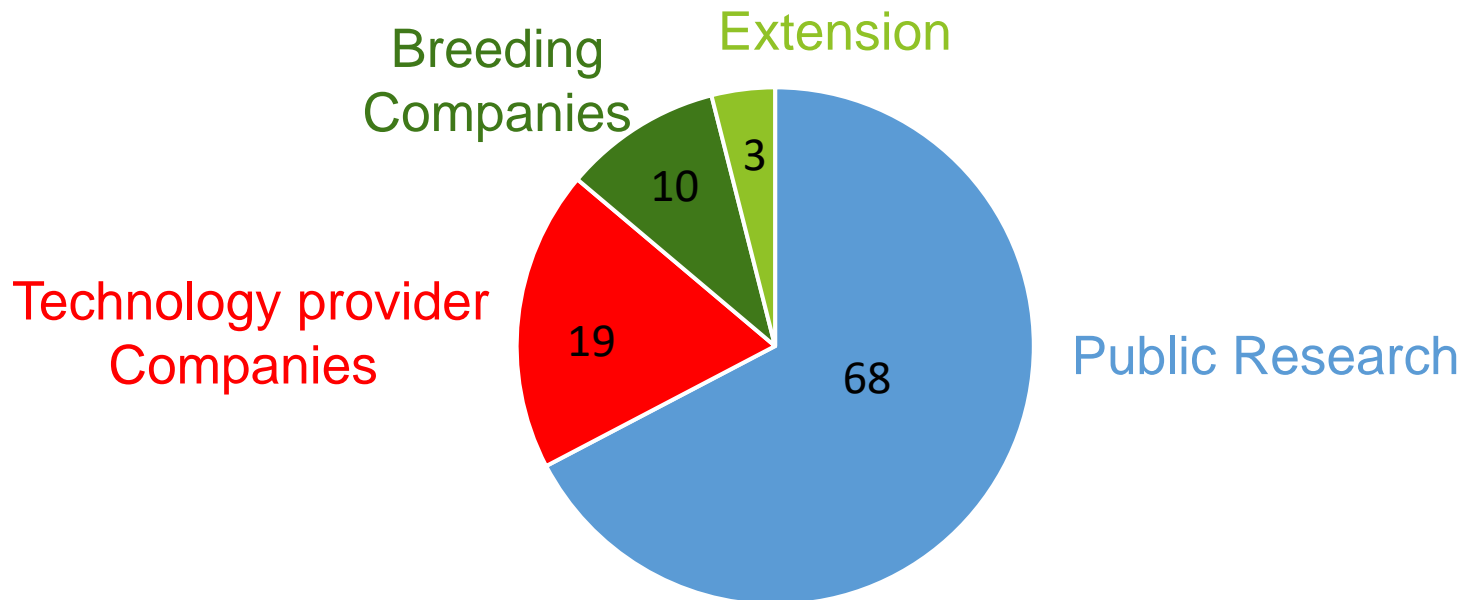
Occurs every year in the French project Phenome Emphasis  
Extended this year to the European phenotyping community, EPPN<sup>2020</sup>

An exchange with stakeholders (seed companies, technology providers, extension, scientists interested in phenomics)

- Objective:**
- **Inform** on the progress of technology
  - **Inform** on the new European landscape of Phenotyping
  - **Collect feedback** from stakeholders: interest, priorities, gaps

# Audience (who are you?)

102 registered





EU project ‘advanced community’  
2017-2021

15 countries  
22 institutions (3 SMEs)  
31 installations

French infrastructure  
2012 - ...

8 local infrastructures  
3 institutions  
15 installations



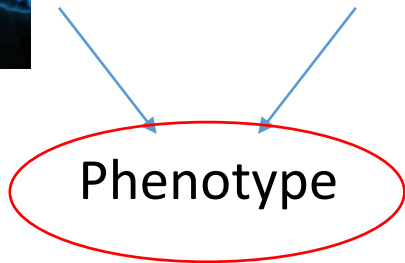
European infrastructure (ESFRI)  
2017-...  
(see U. Schurr’s presentation)

# Phenomic information?

Genome



Environment



Phenotype

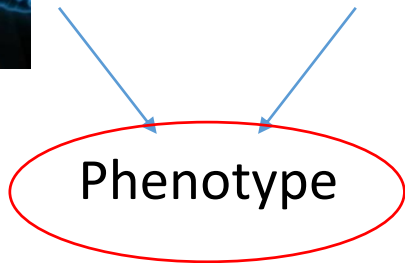
- Phenomic information time consuming and expensive  
Obtain complex datasets, extract maximum information from them  
*Which genotypes perform better where?*  
*Can we predict harvest time of a variety from existing datasets?*
- Phenotypic datasets cannot be reproduced (*set of conditions differ*)  
*Can we infer plant behavior for new genotypes, new conditions?*
- complementarity indoor, field, big data

# Phenomic information: complications?

Genome



Environment



But

Plant structure changes with environment  
(same genome, different structures:  
“different plants”)

Short day



Long day



# Phenomic information: complications?

Genome



Environment<sup>S</sup>

Phenomic datasets

Multi scale  
Phenotype<sup>S</sup>  
in a range of  
environments

But

Plant structure changes with environment  
(same genome, different structures:  
“different plants”)

Short day



Long day



*Tardieu et al 2019 Current Biology ‘from sensors to knowledge’*

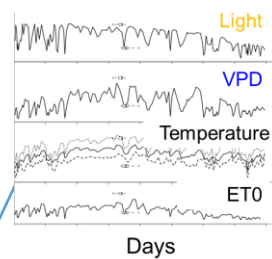
# Phenomic information?

Genome

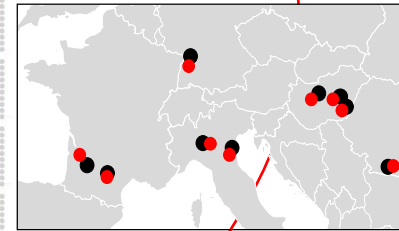
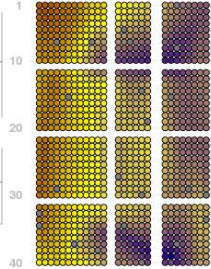


Environment<sup>S</sup>

Temporal  
Variations



Spatial  
Variability



Multi scale  
phenotypes<sup>S</sup>  
in a range of  
environments

Phenomic datasets

*Tardieu et al 2019 Current Biology 'from sensors to knowledge'*



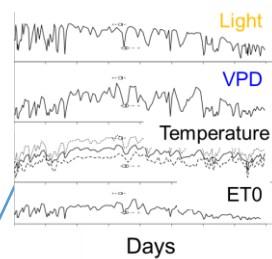
# Challenge 1: sensorics

Genome

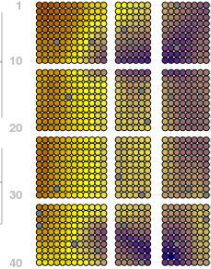


Environment<sup>S</sup>

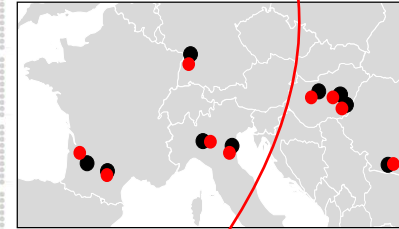
Temporal  
Variations



Spatial  
Variability



Sensors networks  
for envirotyping



Multi scale  
phenotypes<sup>S</sup>  
in a range of  
environments

Phenomic datasets

Sensors, imaging  
for phenotyping

*Tardieu et al 2019 Current Biology 'from sensors to knowledge'*

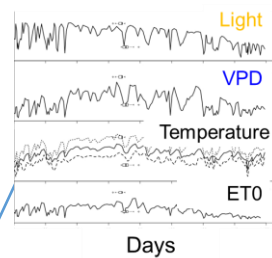
# Challenge 2: Data analysis

Genome

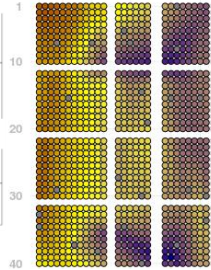


Environment<sup>S</sup>

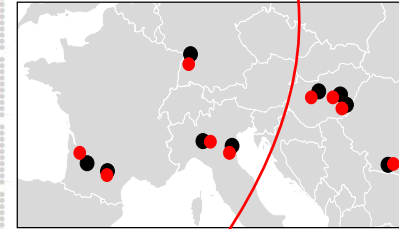
Temporal  
Variations



Spatial  
Variability



Experimental designs  
Spatial corrections



Multi scale  
phenotypes<sup>S</sup>  
in a range of  
environments

Phenomic datasets

Statistical analyses  
Genetics

*Tardieu et al 2019 Current Biology 'from sensors to knowledge'*

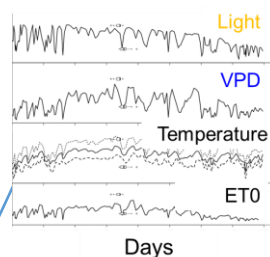
## Challenge 3: Data management

Genome

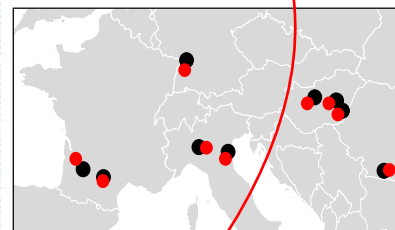
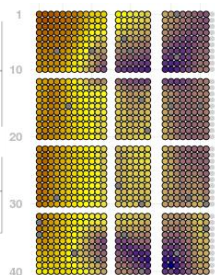


Environment<sup>S</sup>

Temporal  
Variations



Spatial  
Variability



Multi scale  
phenotypes<sup>S</sup>  
in a range of  
environments

Phenomic datasets

Organising datasets so they can be re-analysed  
**FAIR: Findable, Accessible, Interoperable, Reusable**

*Tardieu et al 2019 Current Biology 'from sensors to knowledge'*

Exchange event - 19 March 2021



## ‘Joint research activities’

1. Sensors and images
2. Statistical applications
3. Data management

## ‘Methodological common projects’

1. Sensors, images, artificial intel.
2. Data handling and information systems



10 M€ budget

‘Joint research activities’

1. Sensors and images
2. Statistical applications
3. Data management



45% budget; presentations this morning

‘Transnational accesses’

45% budget; presentation morning R Pieruschka

‘Networking’

10% budget; same + Questions to M Bennett

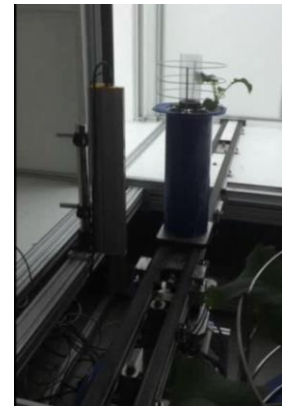
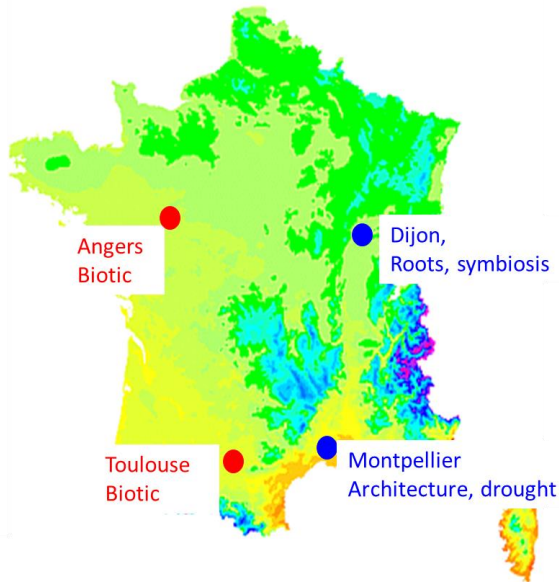
# Some words about Phenome-Emphasis Fr

*ANR grant 29 M€. Full cost 140 M€. 24 M€ co funding, 87 M€ in-kind*

# Some words about Phenome-Emphasis Fr

ANR grant 29 M€. Full cost 140 M€. 24 M€ co funding, 87 M€ in-kind

## Four robotized installations



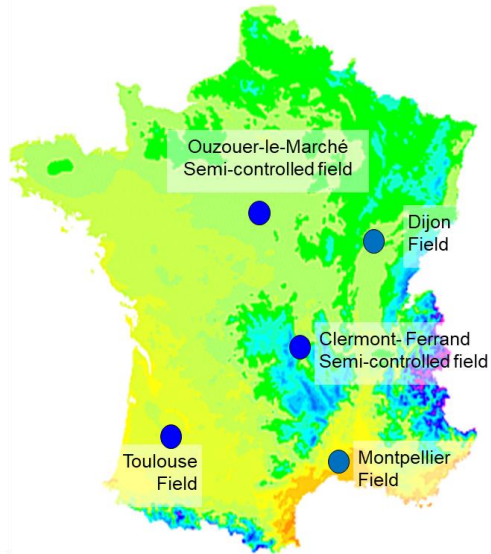
14



# Some words about Phenome-Emphasis Fr

## Five field installations

Including FACE and rainout shelters  
Imaging, phenomobile and drones



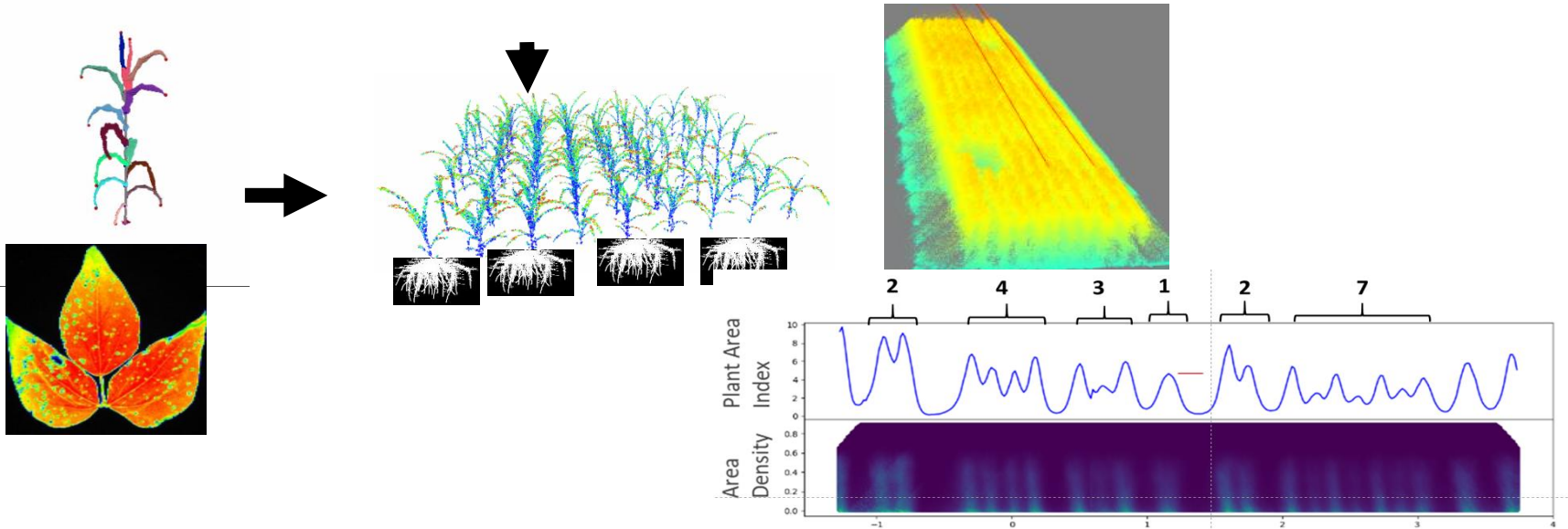
**+2 omic services**  
**Metabolomics, chemiotyping**



# Some words about Phenome-Emphasis Fr

‘Methodological common project’

**Sensors, images, artificial intelligence**  
(priority biotic interactions)



**An automated image analysis pipe line (4P), from drones/phenomobile to traits.**

# Some words about Phenome-Emphasis Fr

‘Methodological common project’

## Data handling and information systems

URI of plant  
<m3p:arch/2017/c17000118>

URI of pot:  
<m3p:arch/2013/pc13001542>

URI of cart:  
<m3p:arch/2013/ct1300123>

URI of cabin:  
<m3p:arch/2018/ac180015>

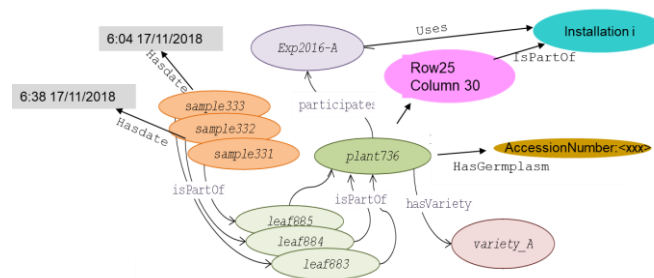
URI of camera:  
<m3p:arch/2018/ac180019>



### Create Variable

Variable Label \*  
MyNewTrait\_MyNewMethod\_NA

Trait	Method
Trait label	Method label
Internal Label MyNewTrait	Internal Label MyNewMethod
Comment This is a comment for y new trait, on which my new variable is focused.	Comment This is a comment for my new method, used to produce the values of my new variable.

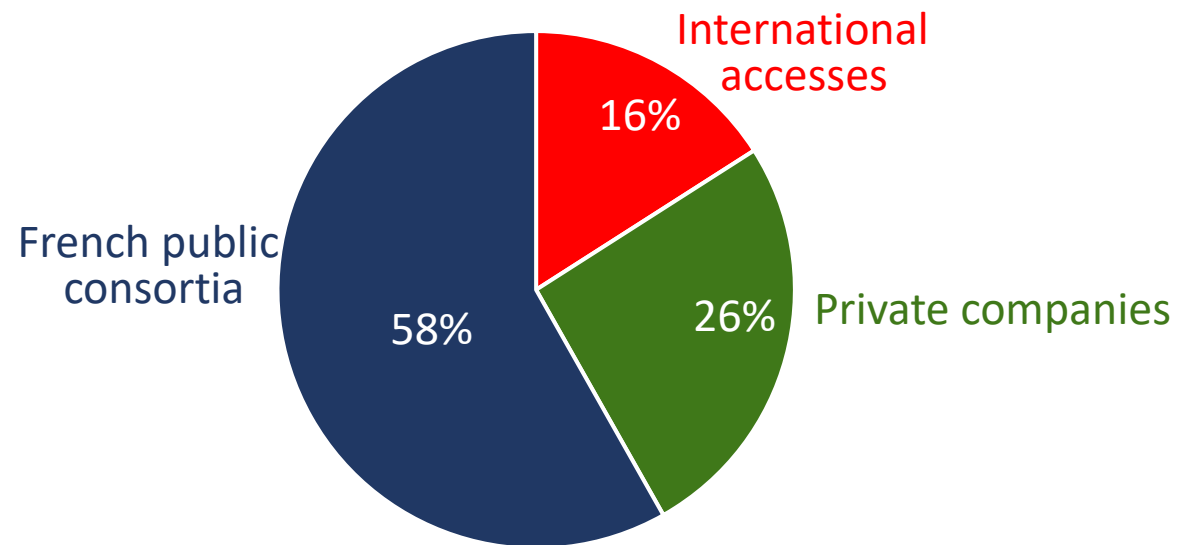


**PHenome Information System (PHIS)**, deployed in French nodes, some EU nodes  
**Available to anybody**

# Some words about Phenome-Emphasis Fr

**464 accesses**

2017-2020



## The European context

- European landscape (EMPHASIS) – *U. Schurr*
- EPPN<sup>2020</sup> Trans-National Access, networking - R. Pieruschka

## Technical progress

- Sensors and imaging technologies, environment – X Draye, T Pridmore
- Design and analysis of phenotyping experiments – F van Eeuwijk, E. Millet
- Data management, information systems – I. Alic, B Usadel
- Discussion, organization of the breakout session afternoon

**14:30 Breakout sessions**

**16:00 Wrap up**