PHENOMOBILE V2

PHENOTYPING

USER FRIENDLY

AUTOMATIC

Robopec
www.robopec.com

hi-phen
INTEGRATED PLANT PHENOTYPING SYSTEMS
www.hiphen-plant.com

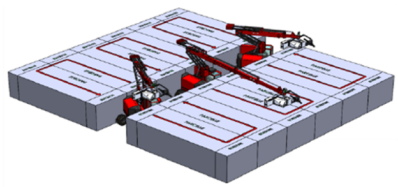
INRA
SCIENCE & IMPACT
www.inra.fr

MECA 3D
www.meca-3d84.com

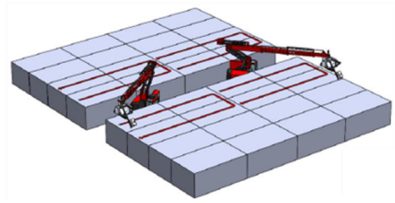
MAIN CHARACTERISTICS

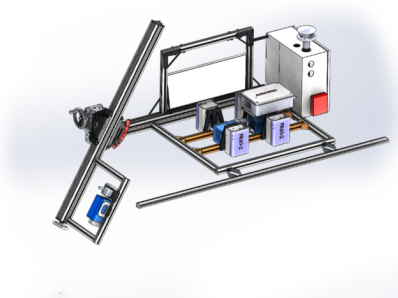
PHENOMOBILE-V2
is a fully automatic unmnaned vehicle specifically designed for high-throughput field phenotyping

→ *The system is designed to run along alleys that are 2.5m width. The telescopic boom that can reach **12m length** and can move in all the directions. The height of the measurement head is automatically adjusted from **1.0m up to 4.5m***



→ *The phenomobile moves automatically over the micro-plots following predefined trajectories within a few centimeters accuracy using a RTK GPS positioning*





→ *The main sensors of the **measurement head** are :*

- *3 Sick LMS400 Lidars*
- *2 RGB Cameras*
- *5 Flashs LUMIX FR60*
- *2 RTK GPS*
- *2 IMU (SBG Ellipse)*
- *1 Windsonic Anemometer*

The measurement head can heasily host new sensors

Weight : 7.85t
Width : 2.46m
Length : 5.2m
Height : 3.15m
Maximum speed : 12km/h
Autonomy : 10h
Turning radius : 3m

→ **Diesel engine powering the hydraulic and electric systems**
→ **4 steering-powered caterpillars**
→ **Airconditioned cabin**
→ **Throughput : >100 microplots/hour**
→ **Caterpillars minimize damages on the soil**

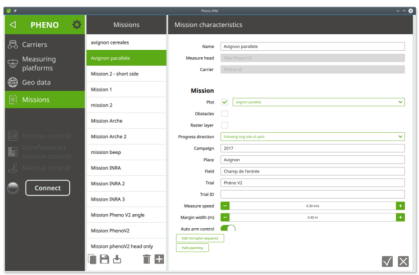
More at : *http://www.robopec.com/en/products/phenotyping/*

SUPERVISION SOFTWARE

CONFIGURE AND MONITOR

with a user friendly software. Create measurement waypoints, create microplots, manage your maps or define the vehicle trajectory. Then monitor the mission.

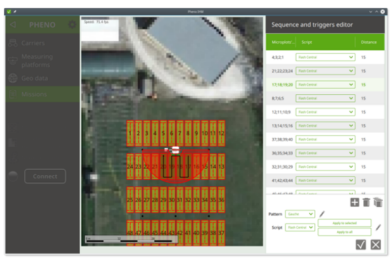
Mission planner software

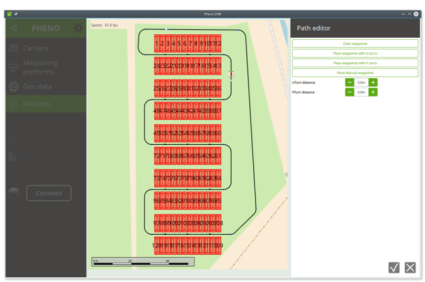


Create your mission and customize all your parameters, configure the sensor head

→ configure and create your missions on Windows or Linux systems

Define your maps
Create the microplots, add the obstacles or import geotiff to display on the map





Create trajectories
Generate the vehicle trajectory and the boom movement patterns over the measurement plots

Live Monitoring

- → real time feedback, monitor your vehicle and the mission progression
- → supervision software running on tablet
- → remote control the vehicle
- → web supervision through 4G

Configure
define your hardware, create measurement scripts and create your maps

Plan
choose micro-plots, plan robot path and configure measurement

Monitor
check mission progression monitor measure

More at : *http://www.robopec.com/en/products/phenotyping/*

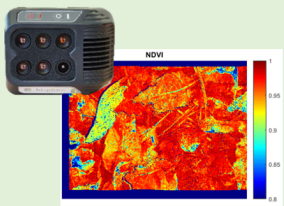
DATA PROCESSING

Phenotyping applications from Phenomobile data

RGB camera

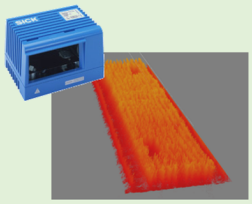
RGB images

Multispectral camera



Multispectral images

LIDAR

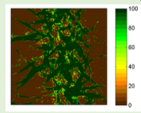


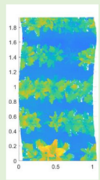
Point clouds

DESCRIPTORS

- Vegetation architecture :
  - Green fraction
  - Leaf Area Index
  - Average leaf angle
  - Chlorophyll content
  - Height
- Organs counting :
  - Number of plants (at early stage)
  - Number of ears
  - Number of flowers
- Phenology (stages detection)
- Disease symptoms quantification :
  - Number of spots
  - Necrosis fraction

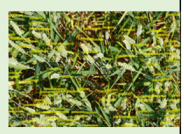
Green fraction

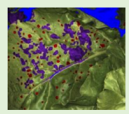




Height

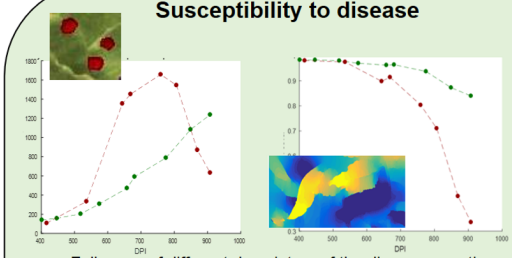
Ears





Detection of spots and necrosis

Susceptibility to disease



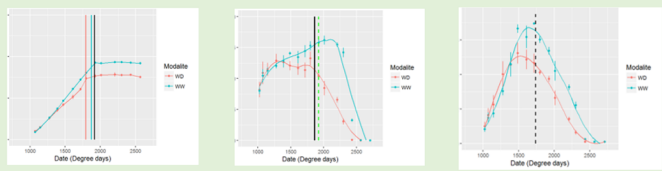
Follow-up of different descriptors of the disease over time

Machine learning

Susceptibility scoring

Genotypes classification on susceptibility to disease criteria

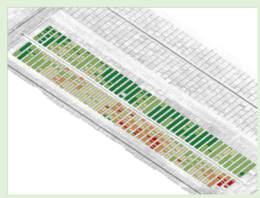
Susceptibility to water deficiency



Follow-up of different architecture descriptors over time on different water input modalities

Phenotyping of water stress effect

Determination of relevant traits for drought-resistant plant breeding



Genotypes classification on susceptibility to water deficiency criteria

- → **Evaluation of seeds quality (from plant counting at emergence)**
- → **Evaluation of resistance to nitrogen deficiencies (from multispectral and chlorophyll assesment)**
- → **Determination of yield components (biomass assesment, radiation use efficiency, water use efficiency …)**
- → **Evaluation of seeds quality (from plant counting at emergence)**
- → **…**

More at : *http://www.robopec.com/en/products/phenotyping/*