

**Dutch NPEC  
Phenotyping  
facilities**

CATHOLICA  
CBQF - CENTRO DE BIODIVERSIDADE  
E QUÍMICA PARA AGRICULTORES ASSOCIADOS  
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WAGENINGEN  
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VITACRESS  
Naturalmente

20 · JULY · 2023  
VITACRESS ODEMIRA, ALENTEJO, PORTUGAL

**STARGATE**  
DRONE WORKSHOP

WAGENINGEN  
UNIVERSITY & RESEARCH

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## Introduction

- Gerrit Polder,
  - 30 years at Wageningen University & Research.
  - Senior scientist computer vision for plant phenotyping
- Background: Electronics/Applied Physics.
  - PhD on Spectral Imaging
- Aim of this presentation:
  - To give an overview of the Netherlands Plant Eco-phenotyping Centre, where our drone facilities are part of.



Contact: [gerrit.polder@wur.nl](mailto:gerrit.polder@wur.nl)

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## Wageningen University & Research

- A university plus R&D organisation for innovation in the agrifood sector.
- Working with industry, governmental authorities and other knowledge institutes
- 7.500 employees
- 15.000 students (BSc/MSc/PhD)
- > 100 countries
- 65 researchers on Agro Food Robotics

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## Netherlands Plant Eco-phenotyping Centre



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## Netherlands Plant Eco-phenotyping Centre

NPEC on the **NWO roadmap** for large scale research infrastructure.

**Budget:** 22 million euros (10 years), funded by the Dutch Science Organization (NWO), Wageningen University and Utrecht University.

Open for access, research visits exchange for universities and industry.



[www.npec.nl](http://www.npec.nl)



Universiteit Utrecht

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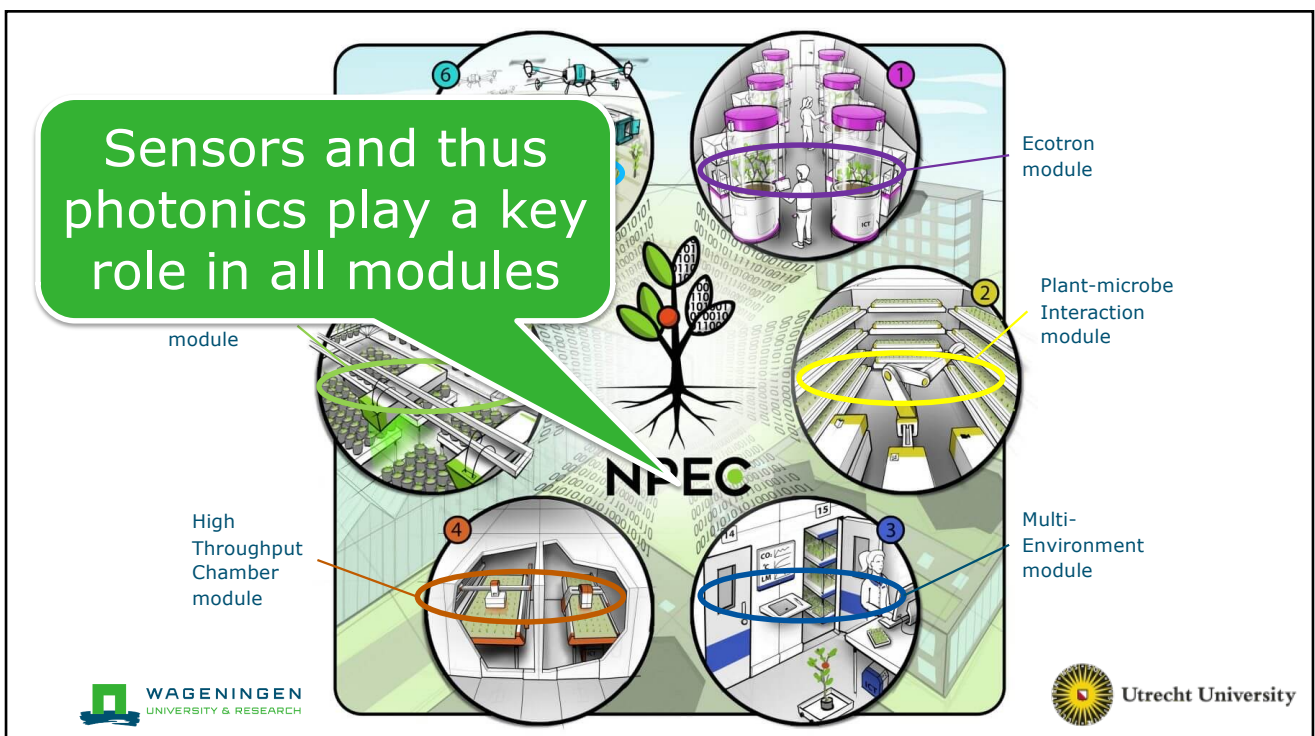


- NPEC is a high-tech plant research facility
- The facility is jointly hosted by Wageningen University and Research and Utrecht University
- In NPEC, we will measure the plant's "phenotype" which means "how a plant looks"
- The facility will be open for national and international academia and industry



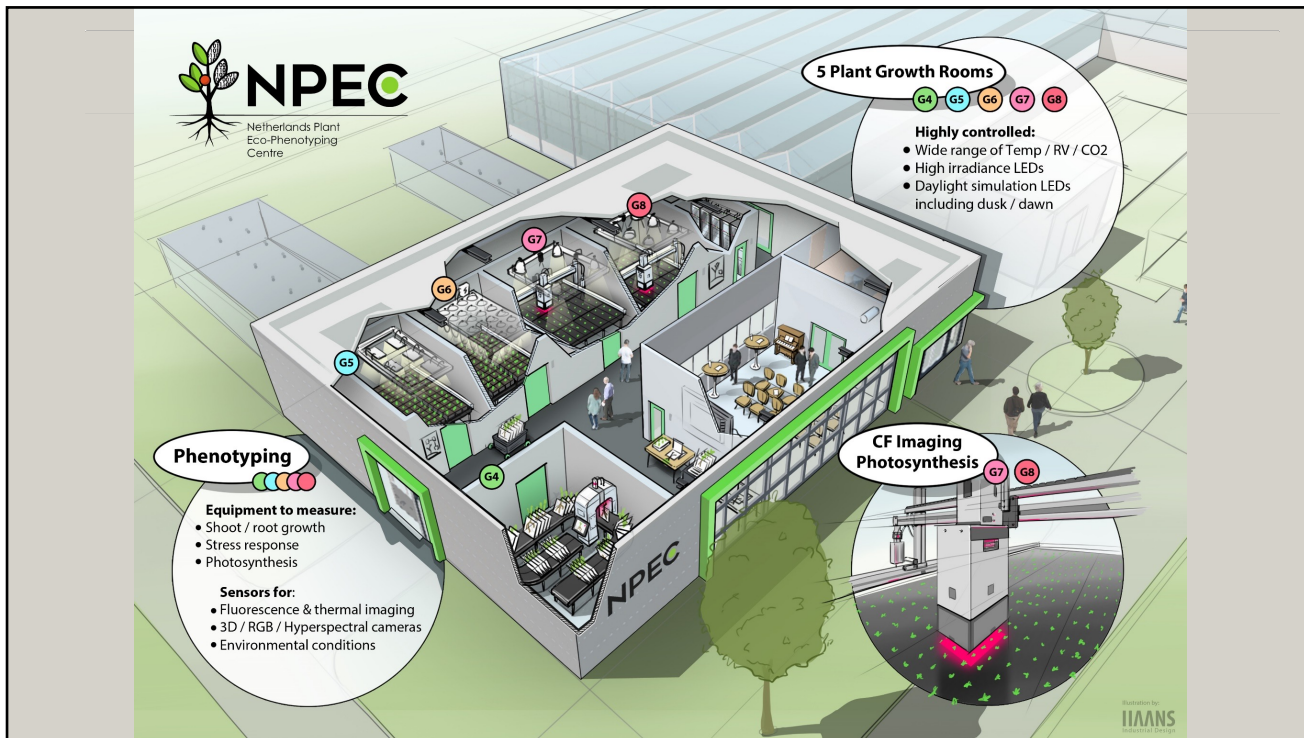
Rick van de Zedde  
www.npec.nl

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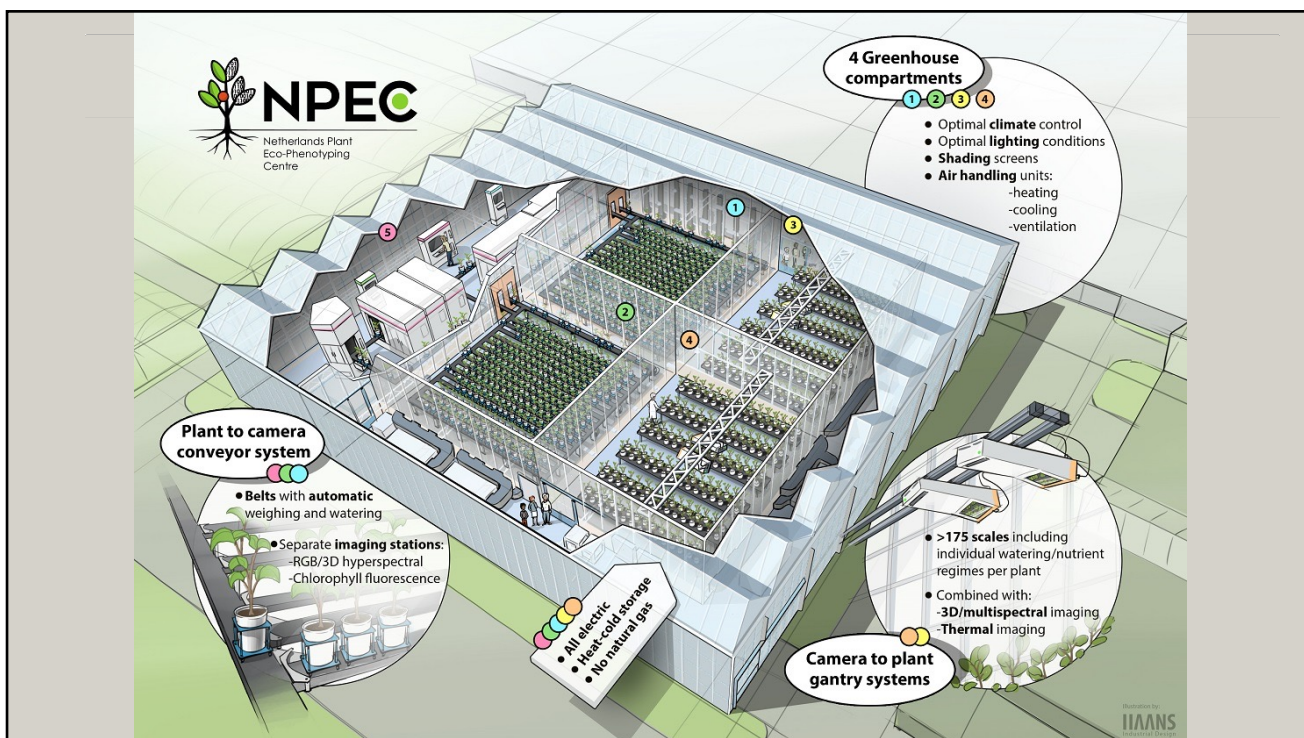


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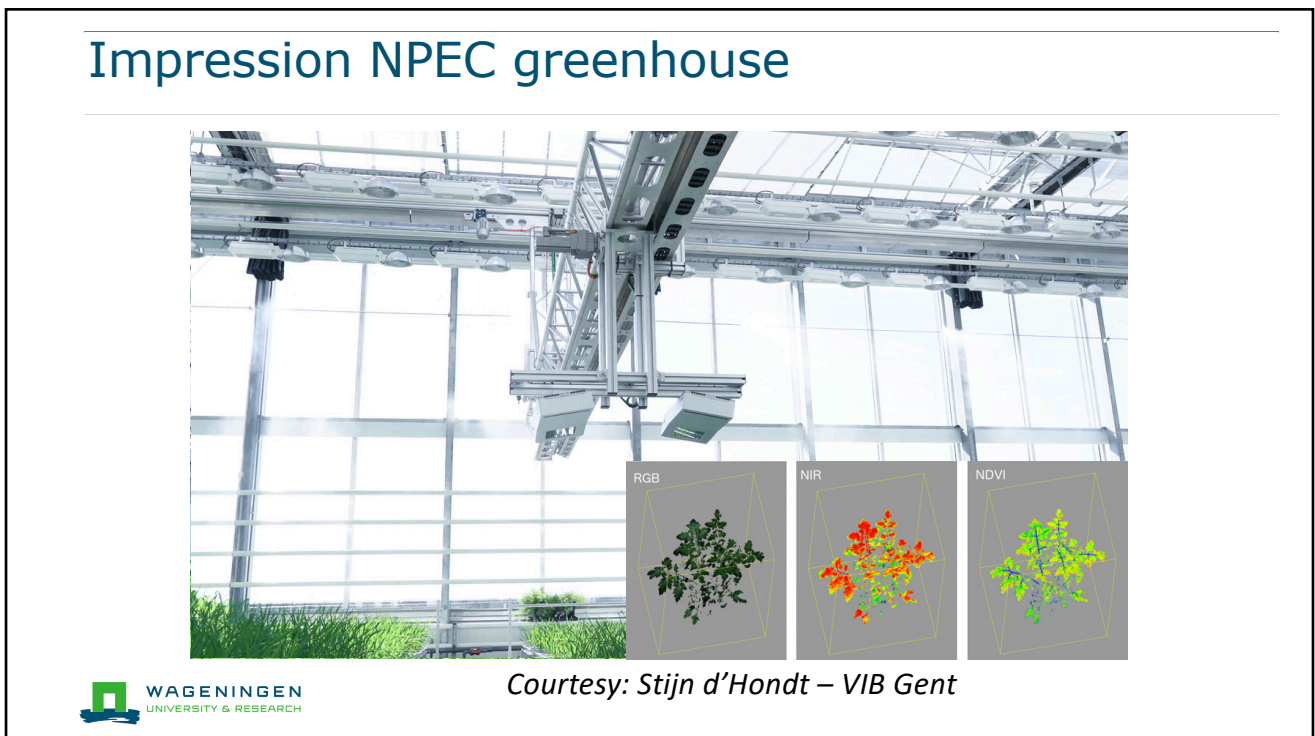


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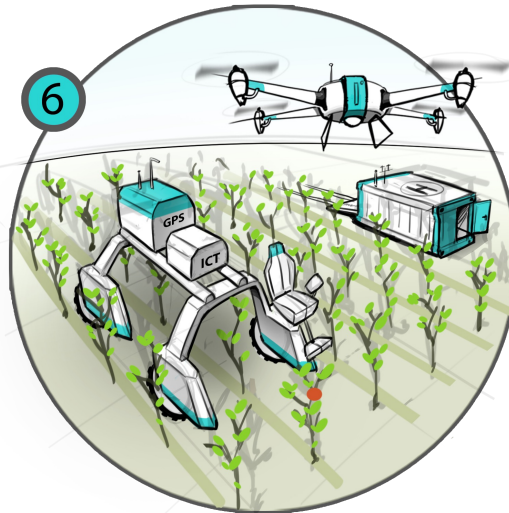


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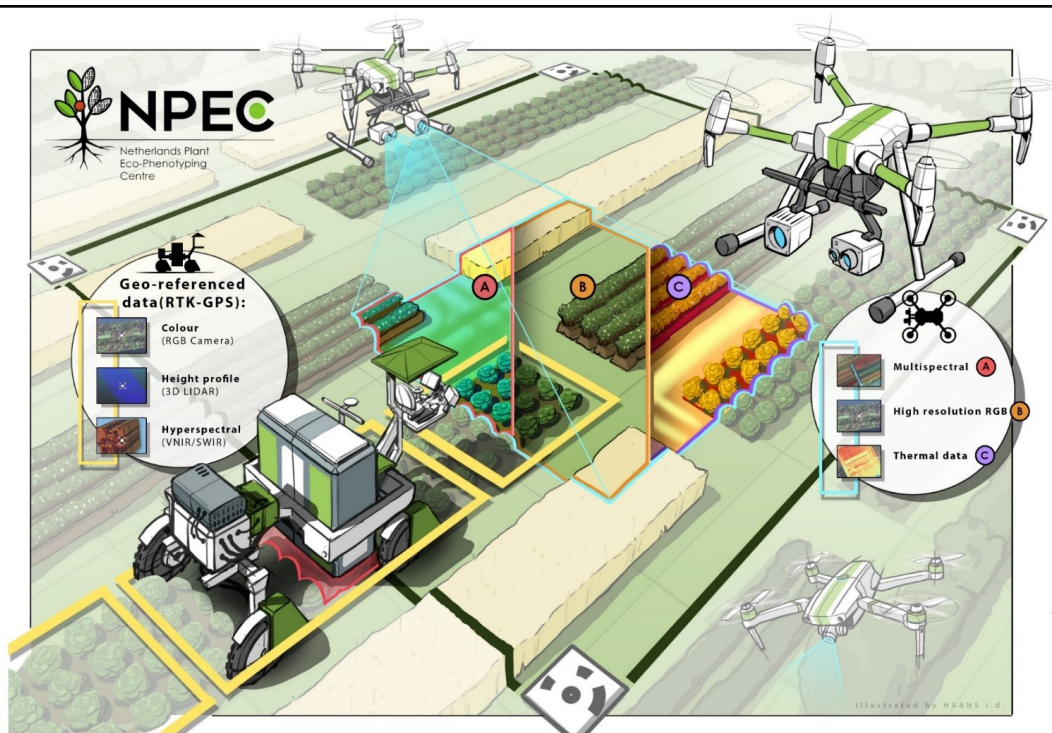
## NPEC Open field module:

Consists of:

- Two M300 drones
- One field vehicle
- Field sensors
- Data integration of field phenotyping equipment into a central data management platform



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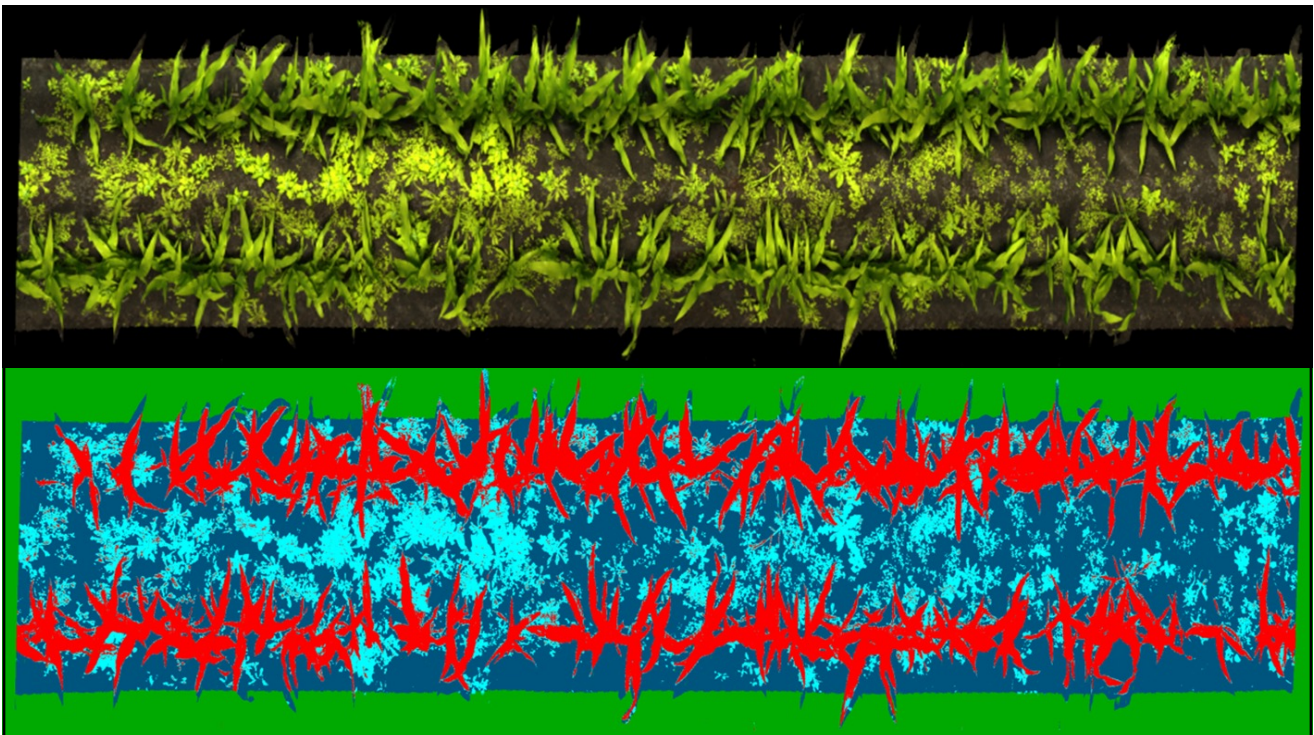


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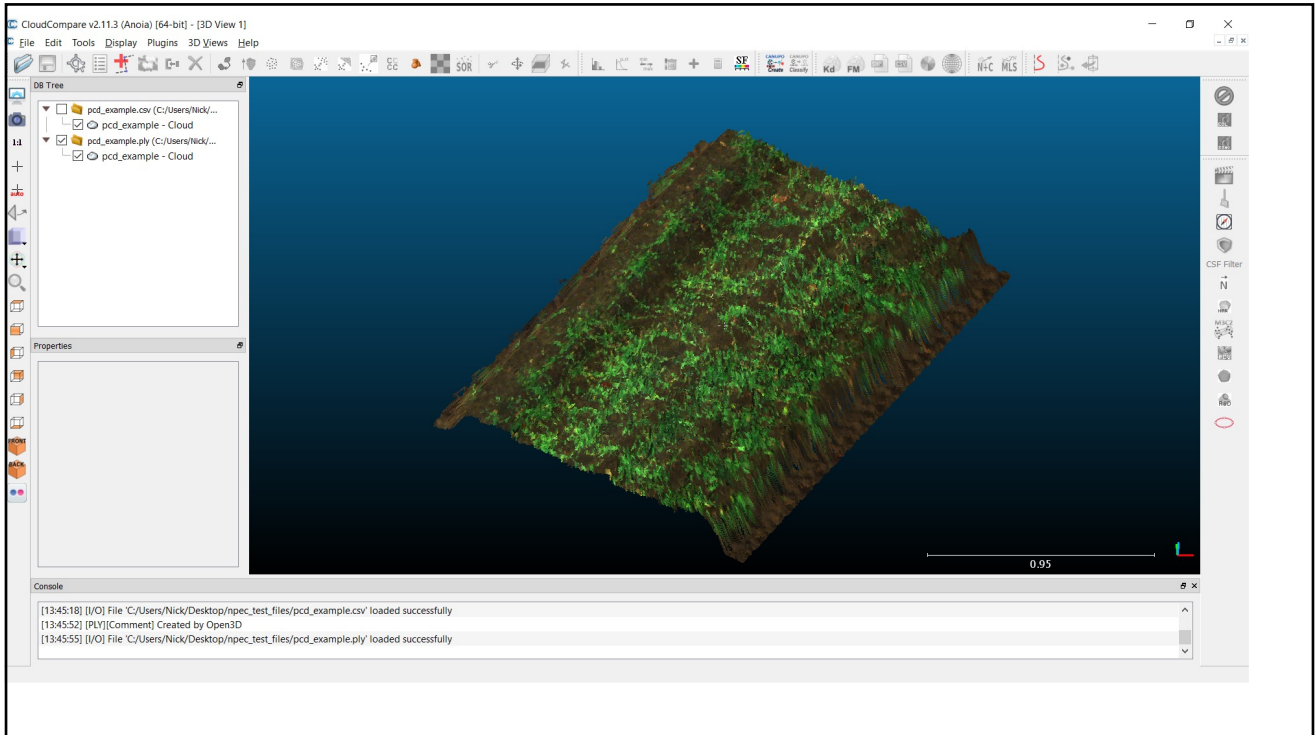




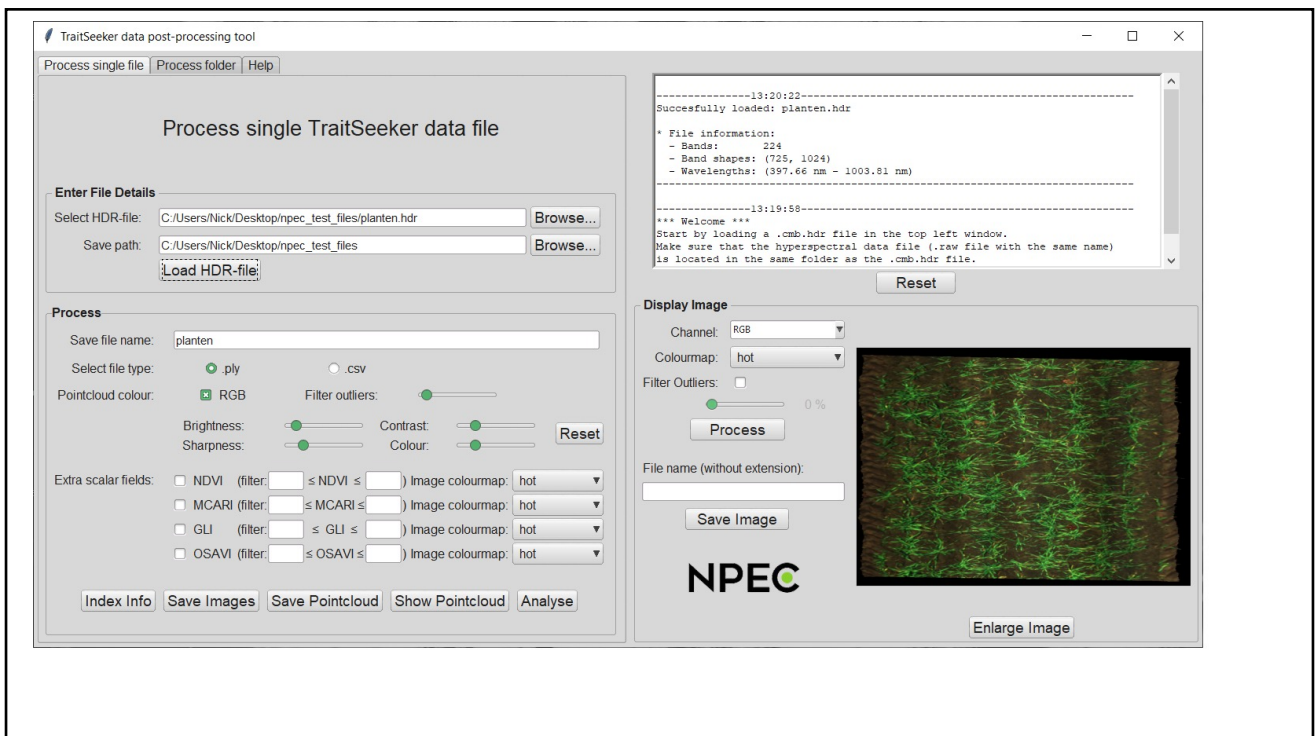
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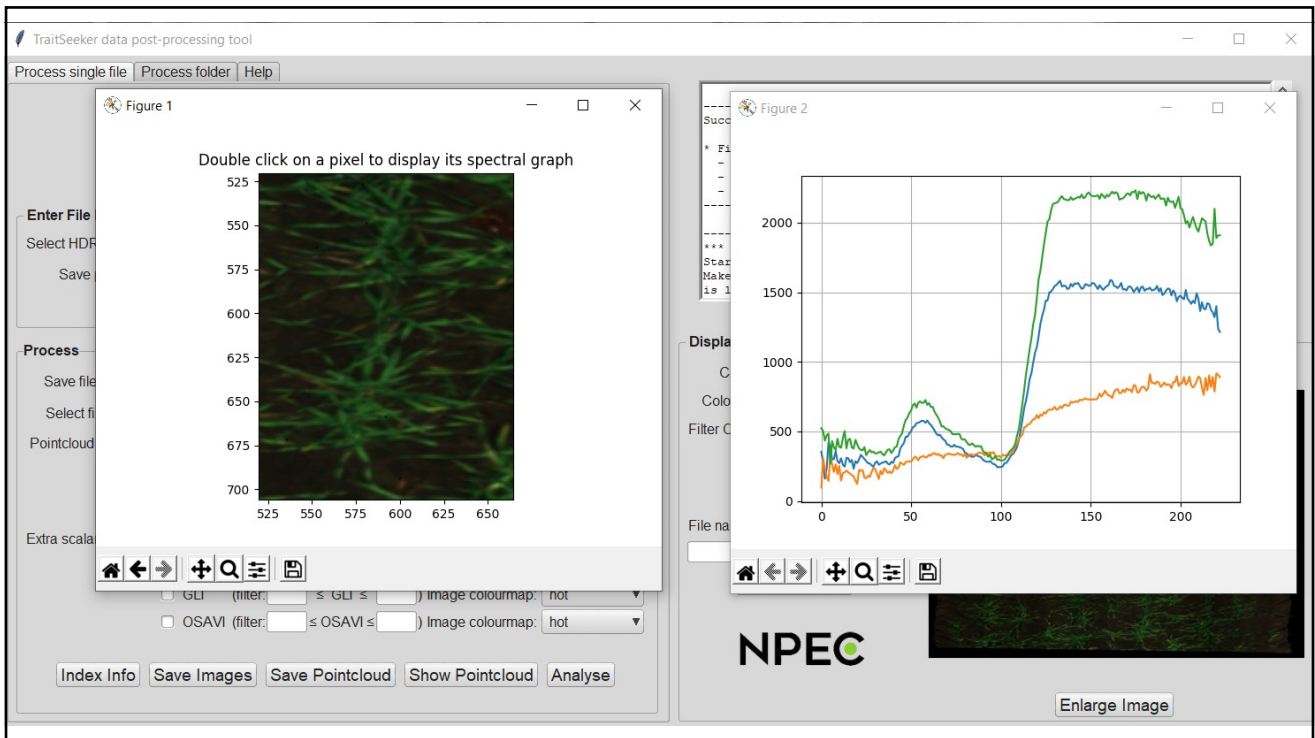


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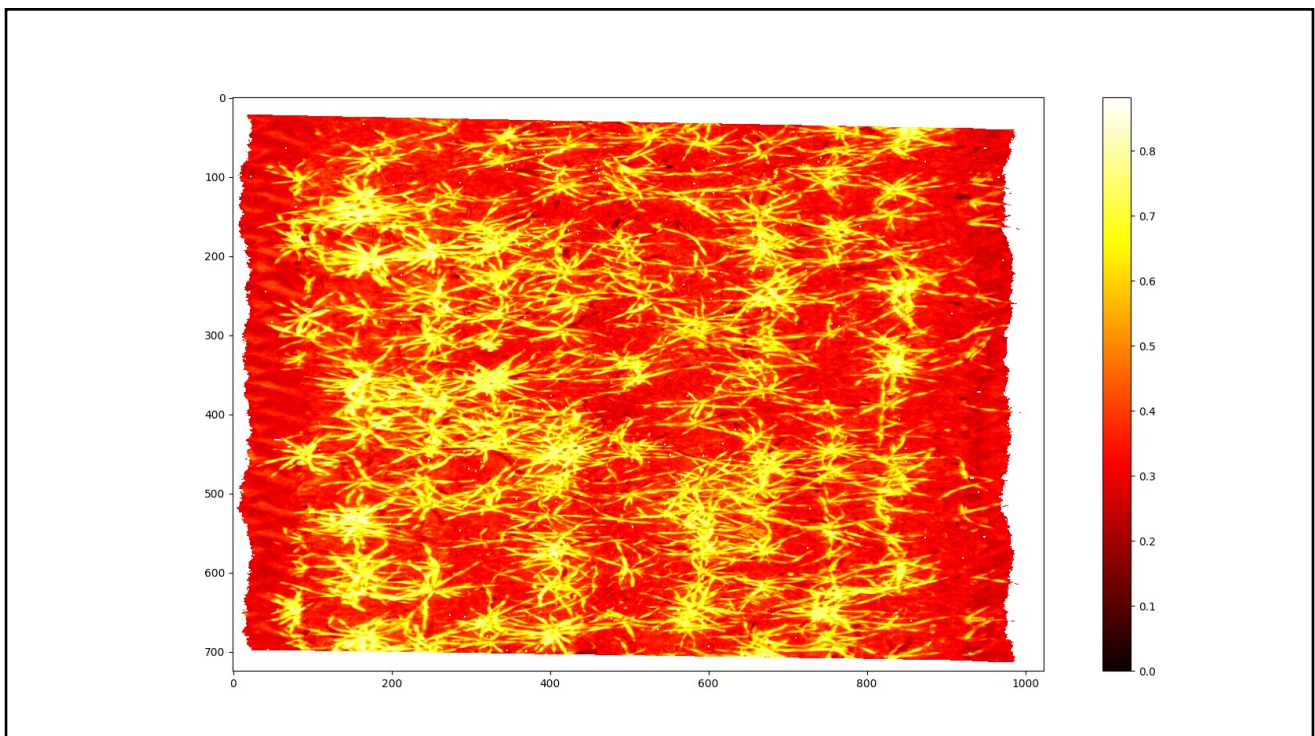


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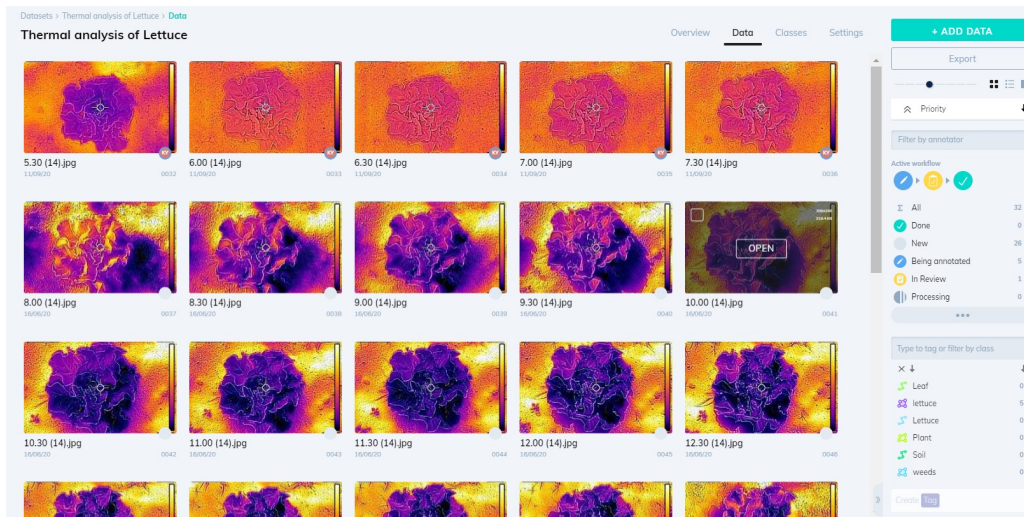


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# Data labelling tools:



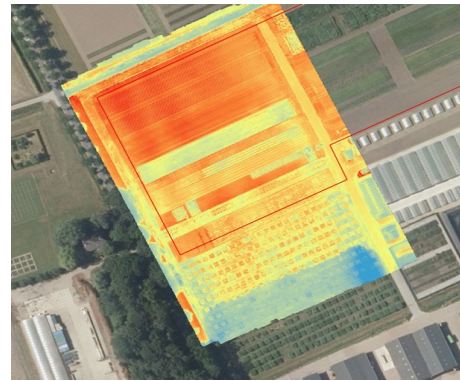
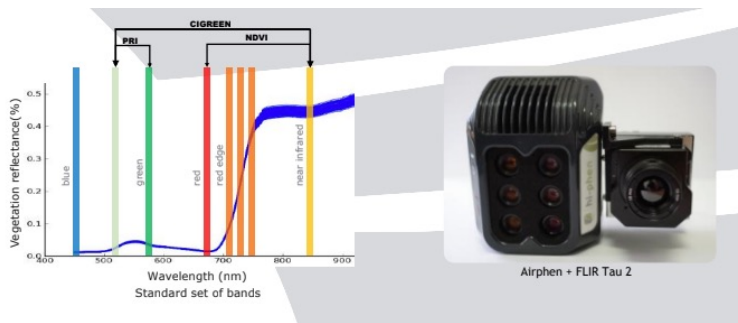
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## Field phenotyping - drones

- 2 DJI Mavic 2 Pro
- 1 DJI Matrice 210 RTK 2.0
  - Zenmuse X5S (20Mp RGB)
  - FLIR Tau 2/ AirPhen combi.



Example Thermal image 19 May 2020 on NPEC field

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## New equipment 2023



DJI M300 RTK



DJI L1  
Lidar



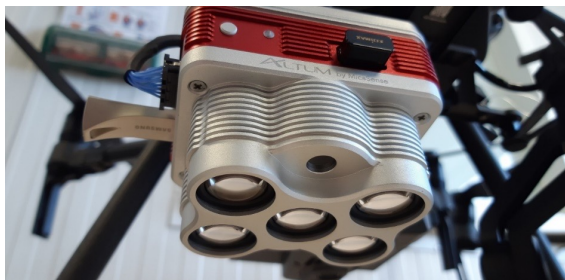
DJI P1 RGB  
(45mp)

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## 2x M300

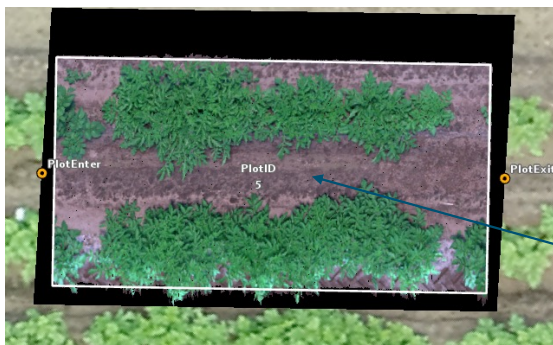
- Multispectral
- Thermal
- RGB



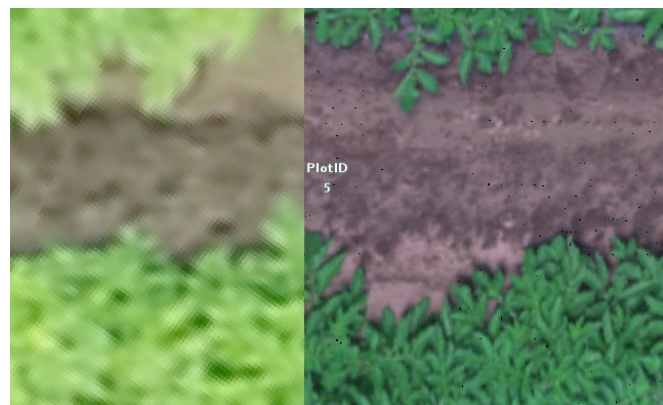
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Drone recording 09-06-2022, RGB, 7mm detail



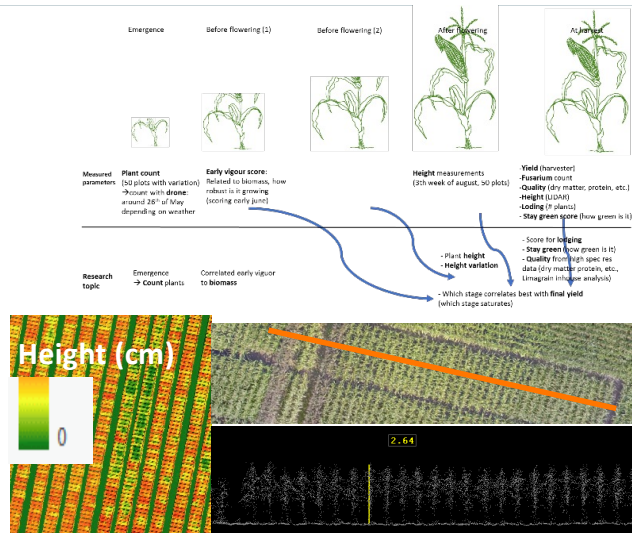
Traitseeker: 10-06-2022, RGB version of spectral image, 1.5 mm detail



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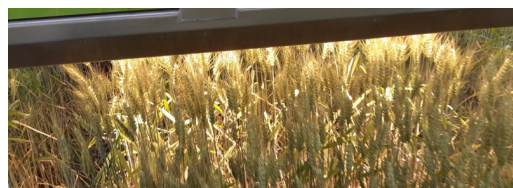
# Phenotyping aspects

- Plant counting
- Plant emergence
- Plant Height
- Plant Biomass
- Plant diseases
- Plant lodging
- Plant ripening
- Plant structure
- Plant quality
- Other plant traits

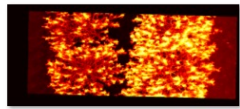


# Example datasets available:

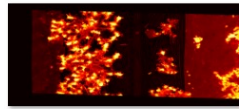
- Barley and violins (from germination 3 months weekly+ scans). Oct 2020 – Dec 2020. NB: 4 Tb of data.
- Lettuce plants multiple plots with drones/ FieldExplorer
- Wheat scans with drones/ FieldExplorer
- Potato plants scans with drones/ FieldExplorer
- Thermal data handheld and drones of lettuce in July + cabbage in January over the day every 20 min, and each minute at noon (made by Kevin Yao).
- Etc.



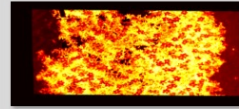
## NDVI images from plots – sorted on disease scoring



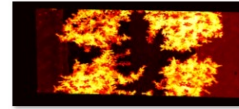
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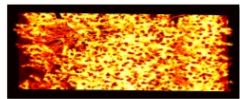
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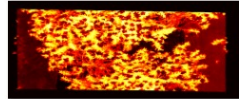
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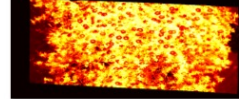
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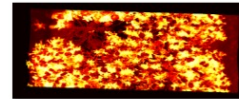
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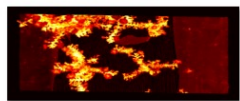
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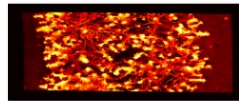
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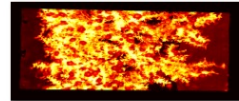
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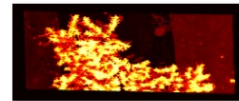
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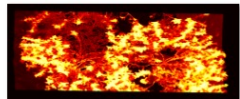
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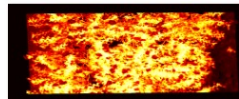
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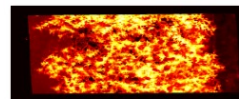
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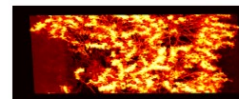
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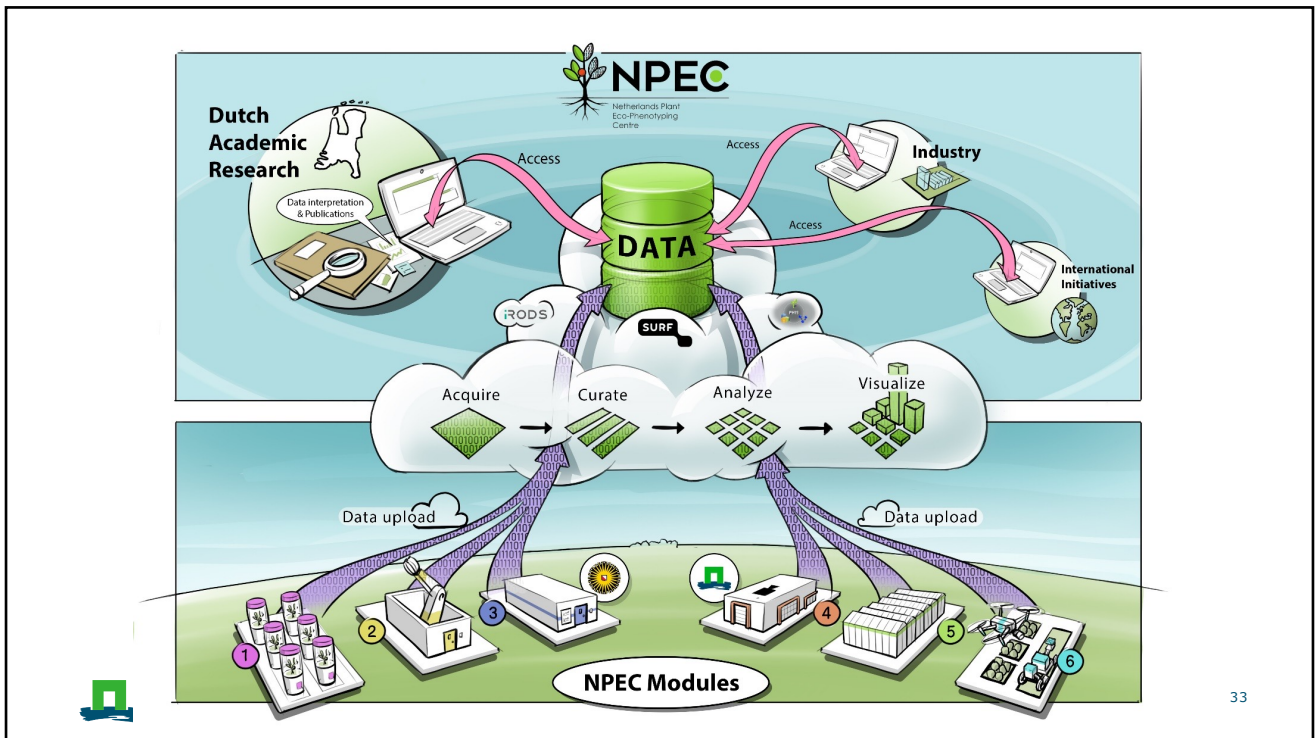
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## NPEC needs an Information System:

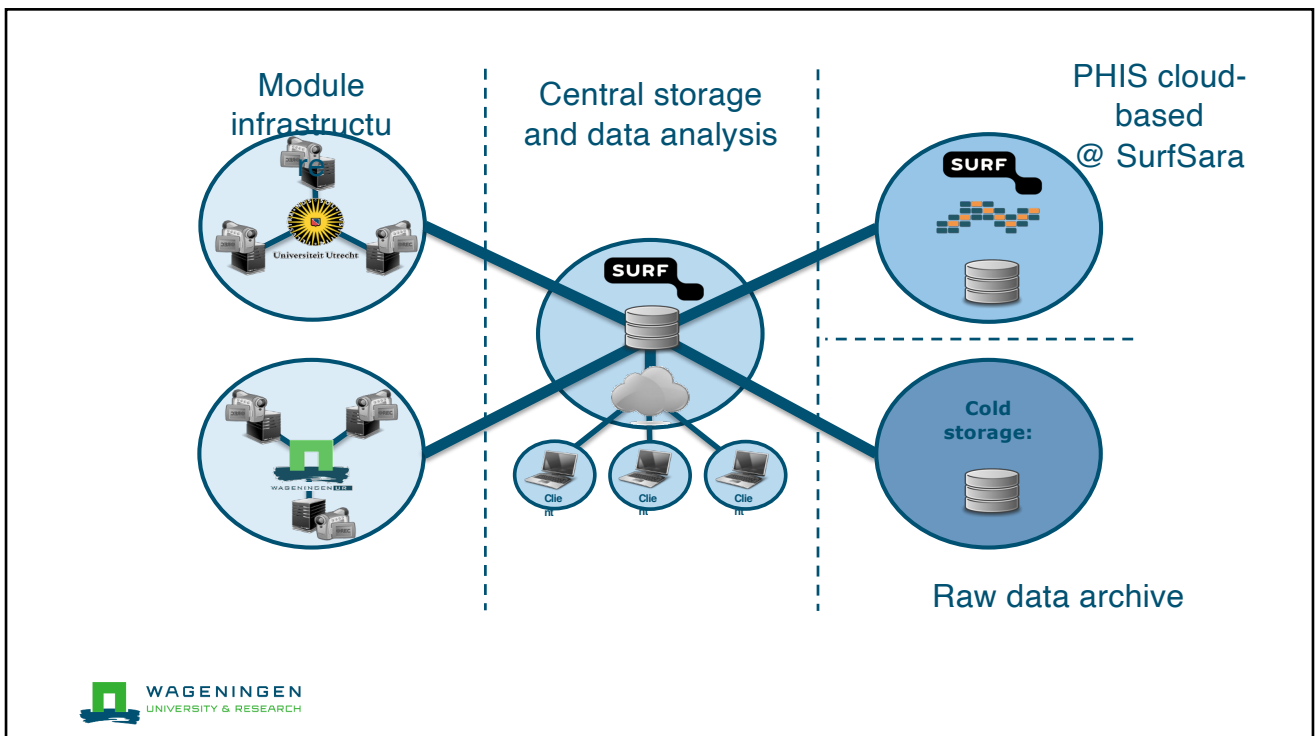
- Store, organise and manage:
  - Highly heterogeneous data (e.g. images, spectra, growth curves)
  - Multi-spatial and temporal scale data (leaf to canopy level)
  - Multi-source (field, platform)
  - Environmental data
- Enrich datasets with knowledge and metadata (enable reuse of data and meta-analyses)
- Interoperate and integrate data into external resources (e.g. modelling platforms or external databases).
- Provide FAIR data (functionally linked)

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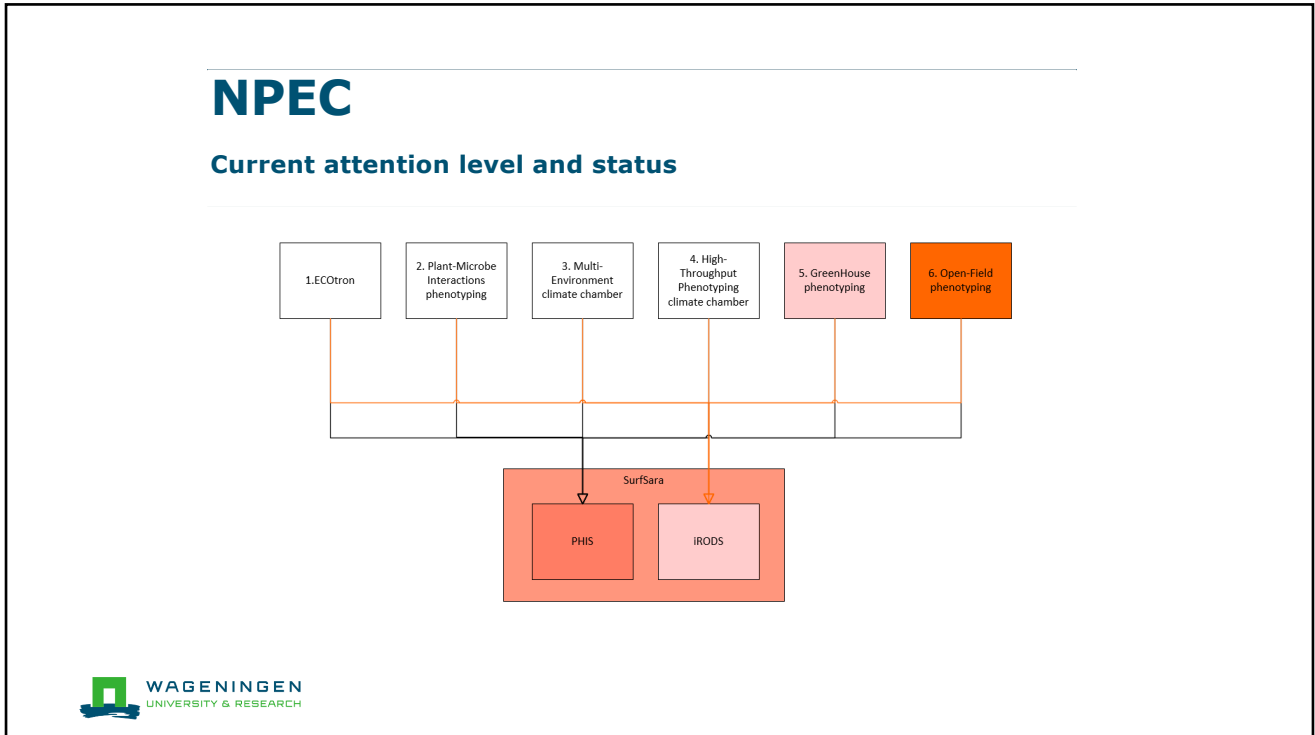




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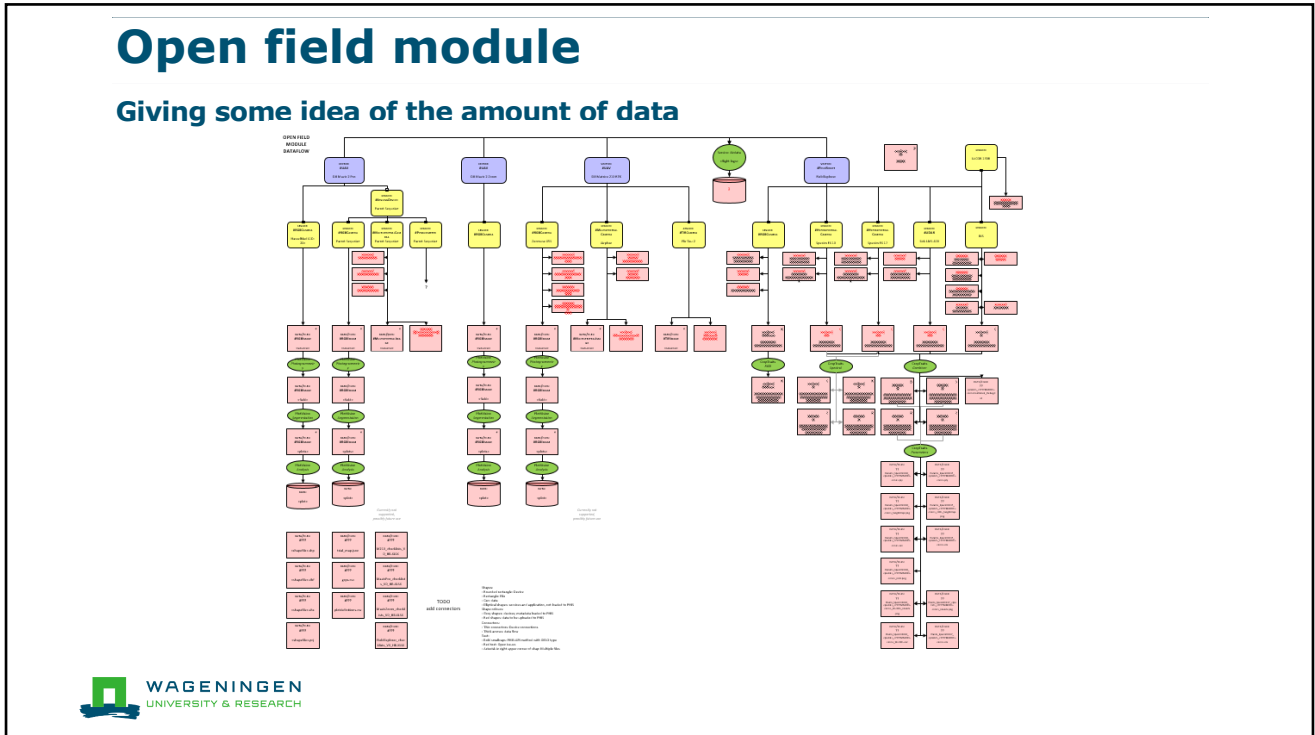
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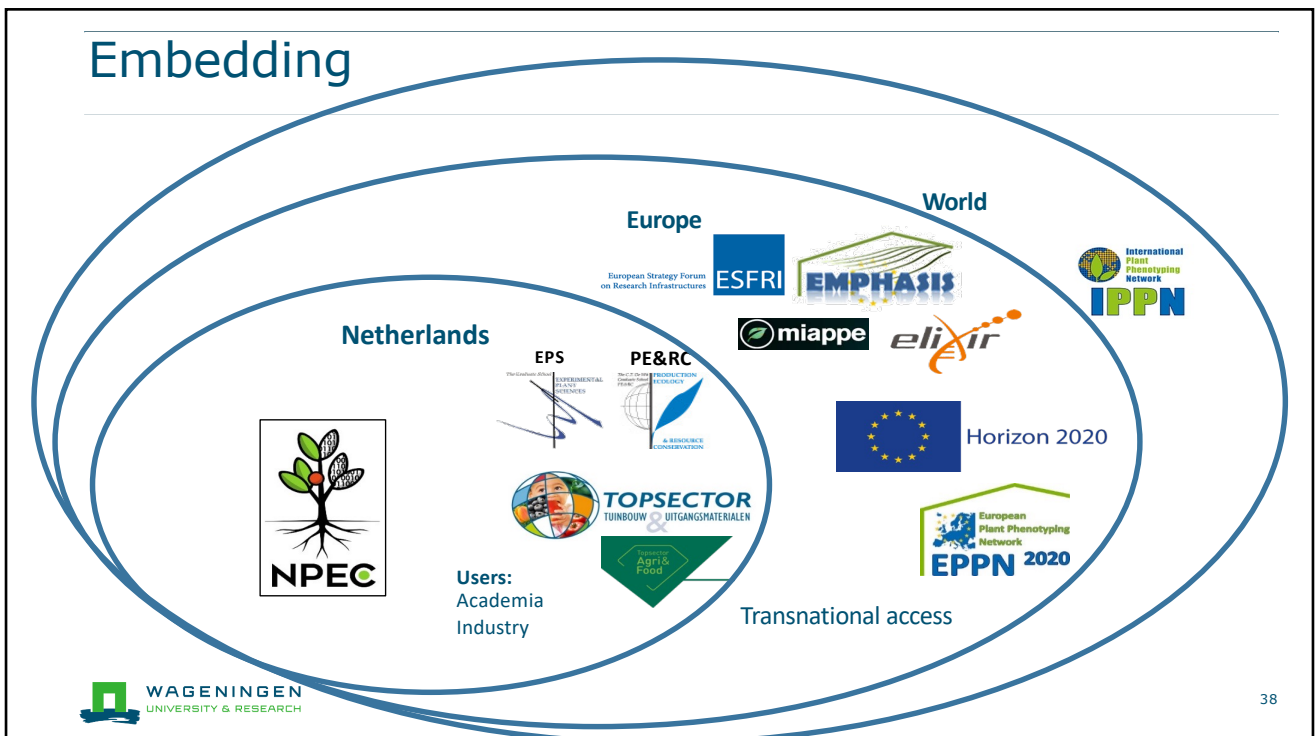
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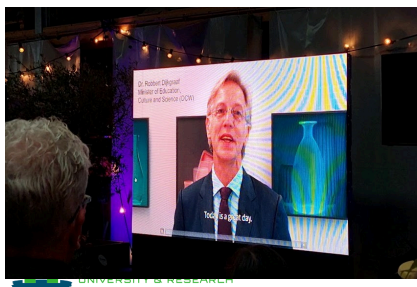
## Partners / TKI partners/ Club van 100

Support/ gebruikers	Leveranciers	Academia

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## Opening NPEC and IPPS2022

- Conference: 450 researchers worldwide
- Key notes, live demonstration, workshops.
- > 100k sponsor budget
- 250 visitors opening NPEC 26 Sept



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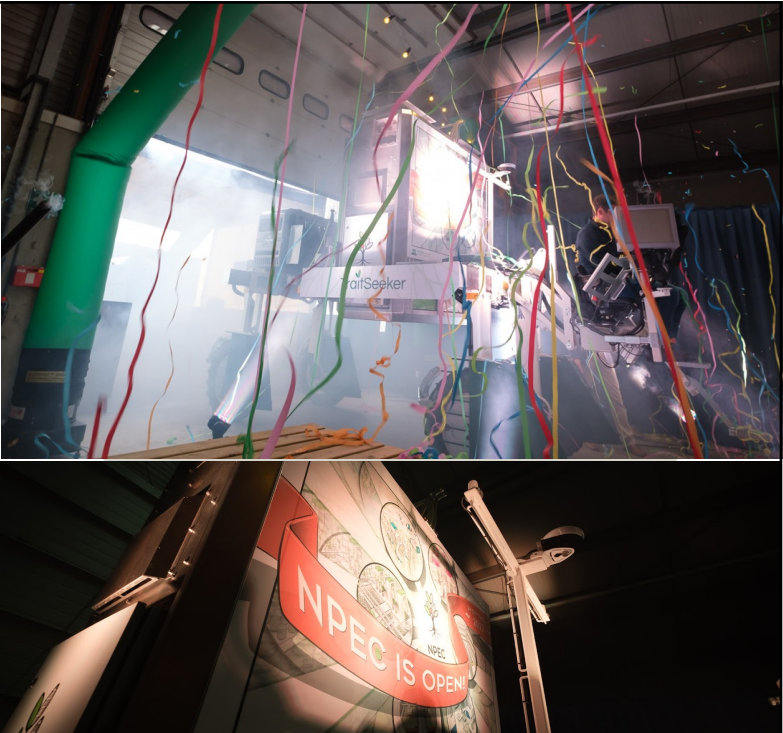


More info: [www.npec.nl](http://www.npec.nl)

*Thanks to input from:*


*Mark Aarts, Rene Klein Lankhorst, Peter Roos, Sven Warris, Lucas Schmitz, Tim van Daalen, Henk Kramer, Basten Snoek, Jannick Verstegen, David Brink, Rinie Verwoert, Tom Theeuwen, Corne Pieterse, George Kowalchuk, Jochem Evers, Katarina Streit and many more!*






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# Announcements





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[Home](#) > MOOC Drones for Agriculture: Prepare and Design Your Drone (UAV) Mission





Online

## MOOC Drones for Agriculture: Prepare and Design Your Drone (UAV) Mission

Take a dive and expand your knowledge about drones and drone technology. Learn how to prepare and execute a flight mission with an Unmanned Aerial Vehicle (UAV) and how to use, process and understand the collected drone data for your own applications.

<b>Organised by</b>	Wageningen University & Research
<b>Duration</b>	3 weeks, 2-5 hours per week


<https://www.edx.org/course/drones-for-agriculture-prepare-and-design-your-dro>

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## Summer School on Image Analysis for Plant Phenotyping

**Organised by**

**Date**

**Duration**


**Location**

Wageningen Academy,  
Wageningen Agro Food Robotics


July 2024

5 days

Wageningen Campus



MARVIN



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**SPIE. PHOTONICS WEST**

Conference LA404  
**Photonic Technologies in Plant and Agricultural Science**

UTILIZATION OF COHERENT AND INCOHERENT LIGHT FOR MANIPULATION OF PLANTS  
OPTICAL IMAGING AND SPECTROSCOPIC SENSING OF PLANTS  
DIGITAL METHODS FOR DATA PROCESSING IN PLANT AND AGRICULTURAL SCIENCE



27 January - 1 February 2024  
San Francisco, California, United States

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Questions



<https://www.wur.nl/en/Research-Results/Projects-and-programmes/Agro-Food-Robotics.htm>

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