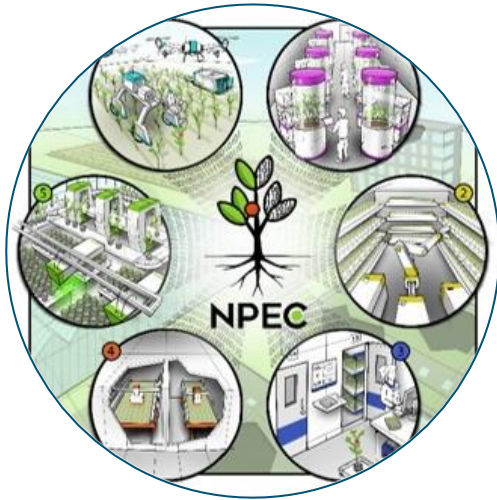


Netherlands Plant Eco-phenotyping Centre (NPEC)

Measuring and understanding plants to improve performances

Rick van de Zedde – March 29th 2022 Ghent



Introduction

- Rick van de Zedde, 18 years at Wageningen University & Research.
Senior scientist/ business developer Phenomics and Automation.
Project manager Netherlands Plant Eco-phenotyping Centre (NPEC).
March 2020: Vice-chair academic section of the International Plant Phenotyping Network (IPPN)
- Background: Artificial Intelligence.
Focus: computer vision/ robotics
- Aim of this presentation:
To inspire and discuss research & developments in phenotyping projects.

Wageningen University & Research

- 2 organisations - A university plus R&D organisations,
"To explore nature and to improve the quality of life".

- Turnover > € 700 mln

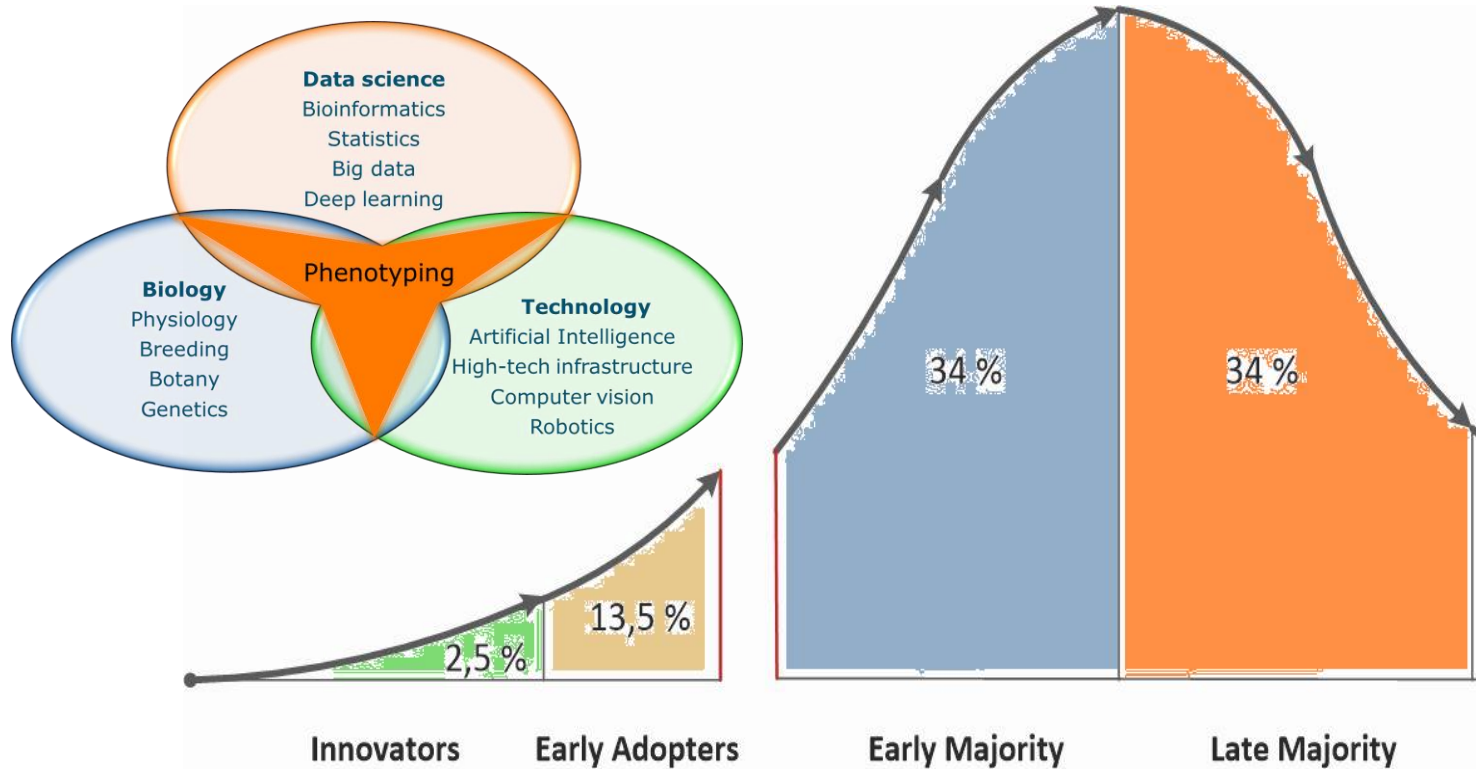
- 5,400 employees

*Ca. 65 researchers on Automation
& Robotics*

- 13,000 students
> 125 countries !



Phenotyping – a multi-disciplinary domain



Genotype \neq phenotype

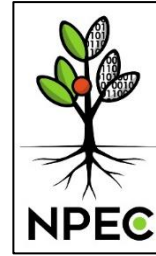


Genotype

+



Environment



=



Phenotype

Netherlands Plant Eco-phenotyping Centre

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

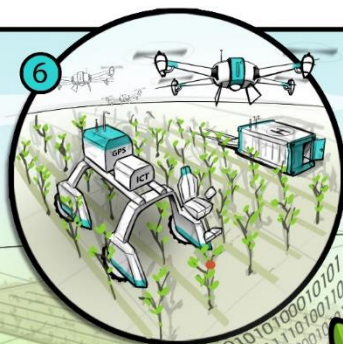
Budget: 22 million euros (10 years), funded by the Dutch Science Organization (NWO), Wageningen University and Utrecht University.

Open for access in 2022 for universities and industry.

Grand opening: 26 Sept 2022, as part of the www.IPPS7.org

www.npec.nl

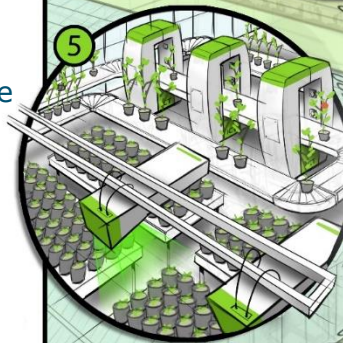
Open Field
module



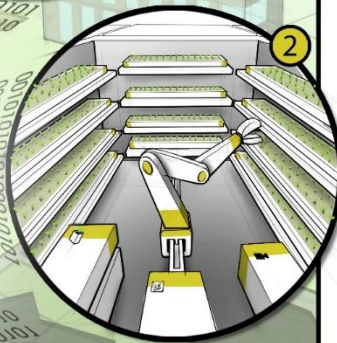
Ecotron
module



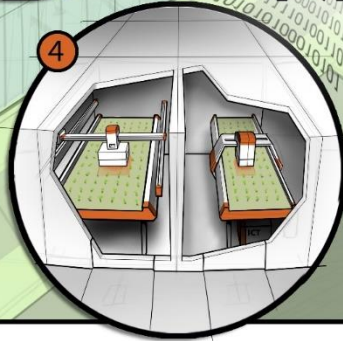
Greenhouse
module



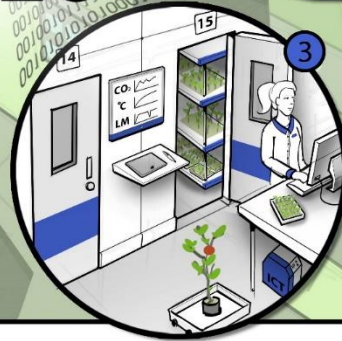
Plant-microbe
Interaction
module

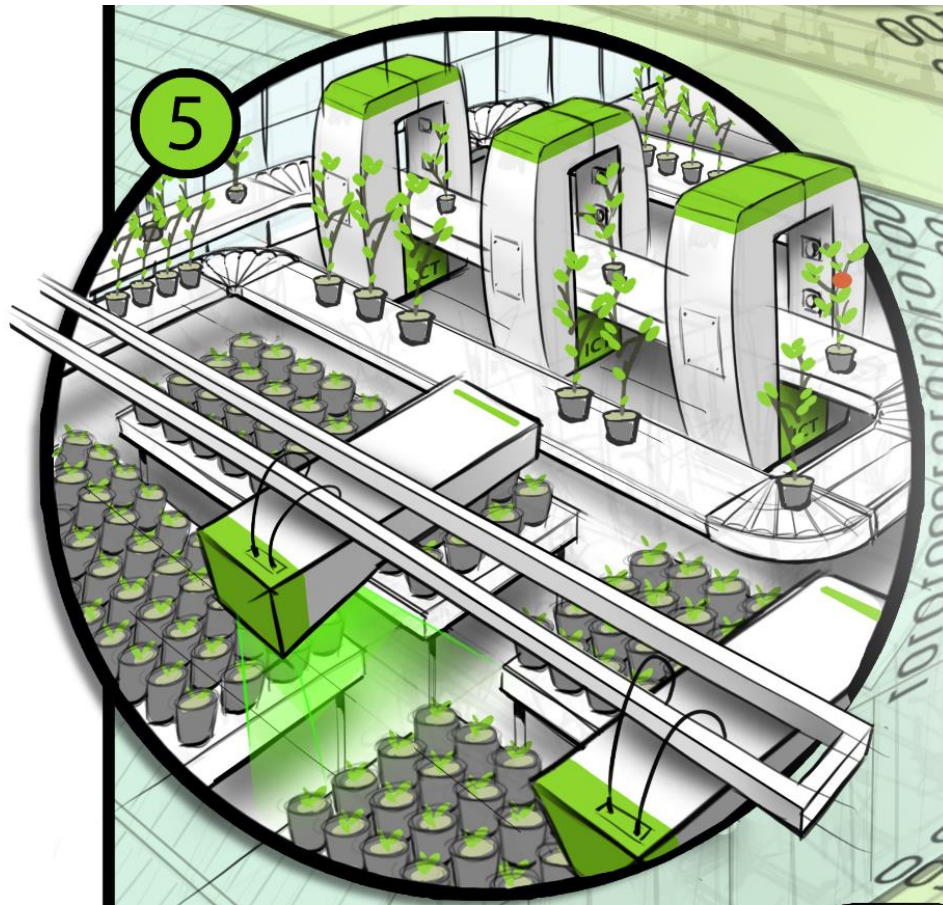


High
Throughput
Chamber
module



Multi-
Environment
module





4 Greenhouse compartments

1 2 3 4

- Optimal **climate** control
- Optimal **lighting** conditions
- **Shading** screens
- **Air handling** units:
 - heating
 - cooling
 - ventilation

Plant to camera conveyor system

- Belts with **automatic** weighing and watering

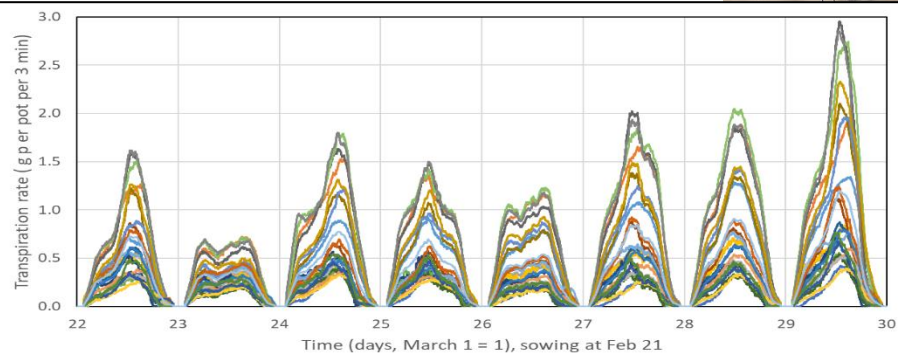
- Separate **imaging stations**:
 - RGB/3D hyperspectral
 - Chlorophyll fluorescence

- All electric
- Heat-cold storage
- No natural gas

- >175 scales including individual watering/nutrient regimes per plant
- Combined with:
 - 3D/multispectral imaging
 - Thermal imaging

Camera to plant gantry systems

Impressions: Quinoa drought stress



High-Resolution Analysis of Growth and Transpiration of Quinoa Under Saline Conditions

 Viviana Jaramillo Roman^{1,2†},  Rick van de Zedde³,  Joseph Peller³,  Richard G. F. Visser¹,  C. Gerard van der Linden¹ and  Eibertus N. van Loo^{1*}

¹Plant Breeding, Wageningen University and Research, Wageningen, Netherlands

²Graduate School Experimental Plant Sciences, Wageningen University, Wageningen, Netherlands

³Wageningen Plant Research, Wageningen, Netherlands

Front. Plant Sci., 05 August 2021

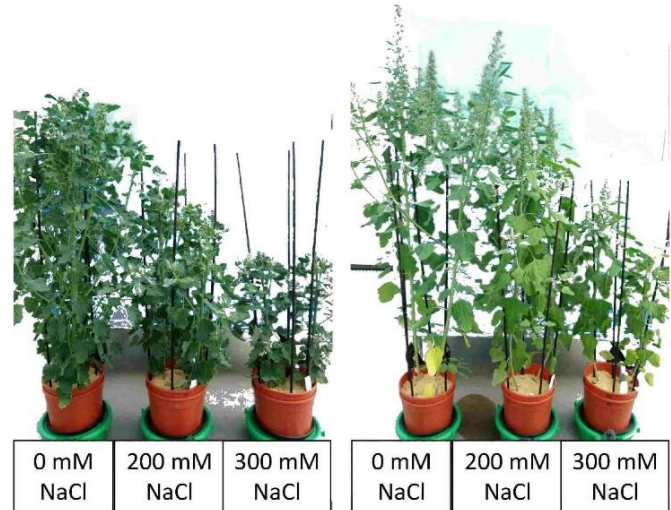
| <https://doi.org/10.3389/fpls.2021.634311>



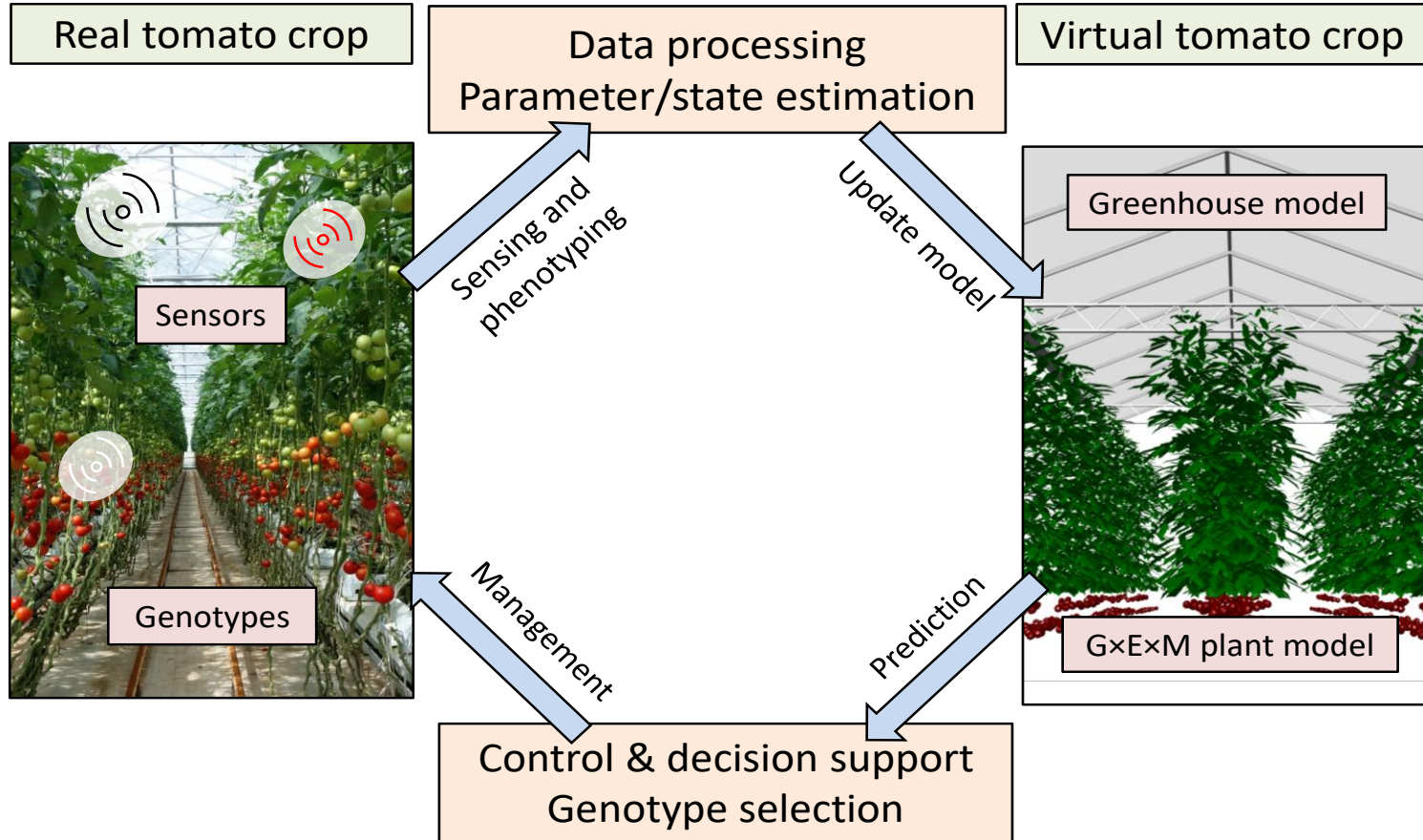
B

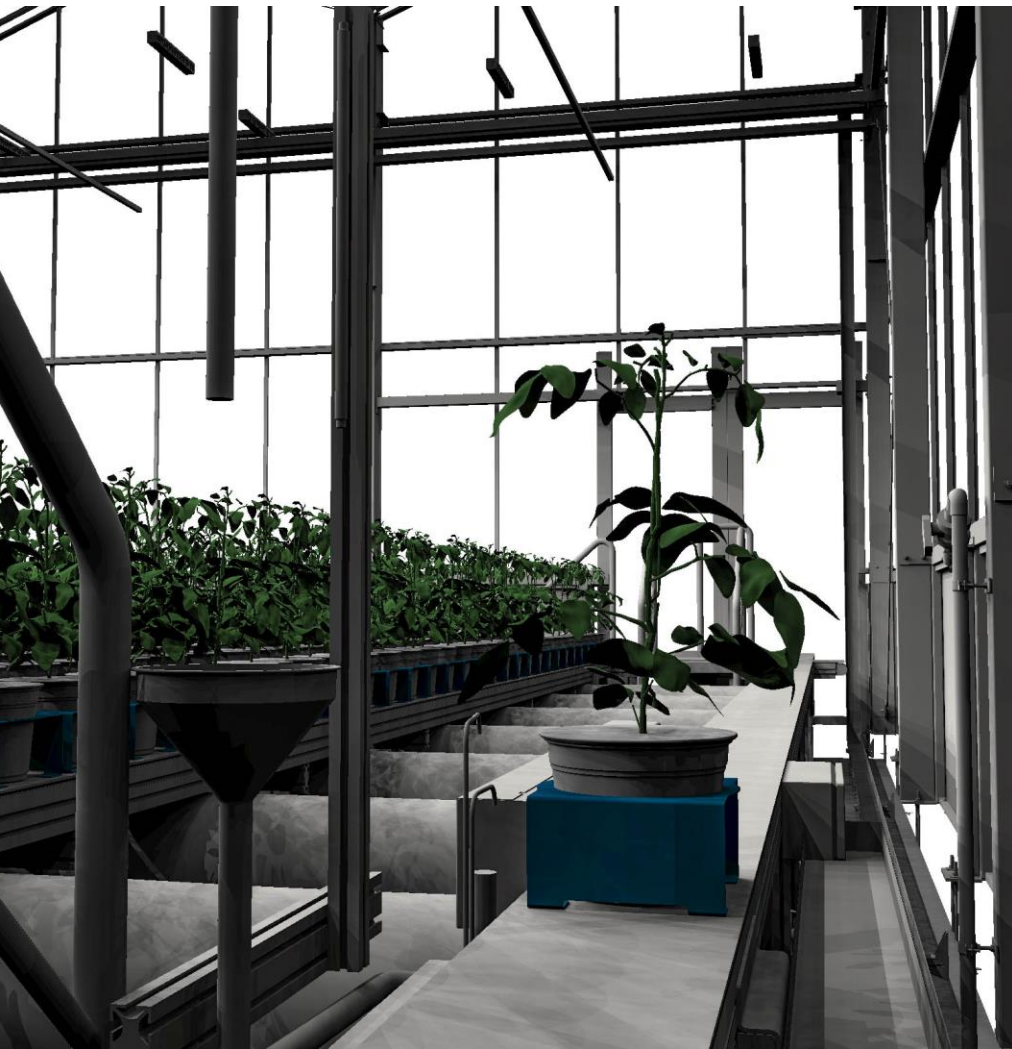
Pasto

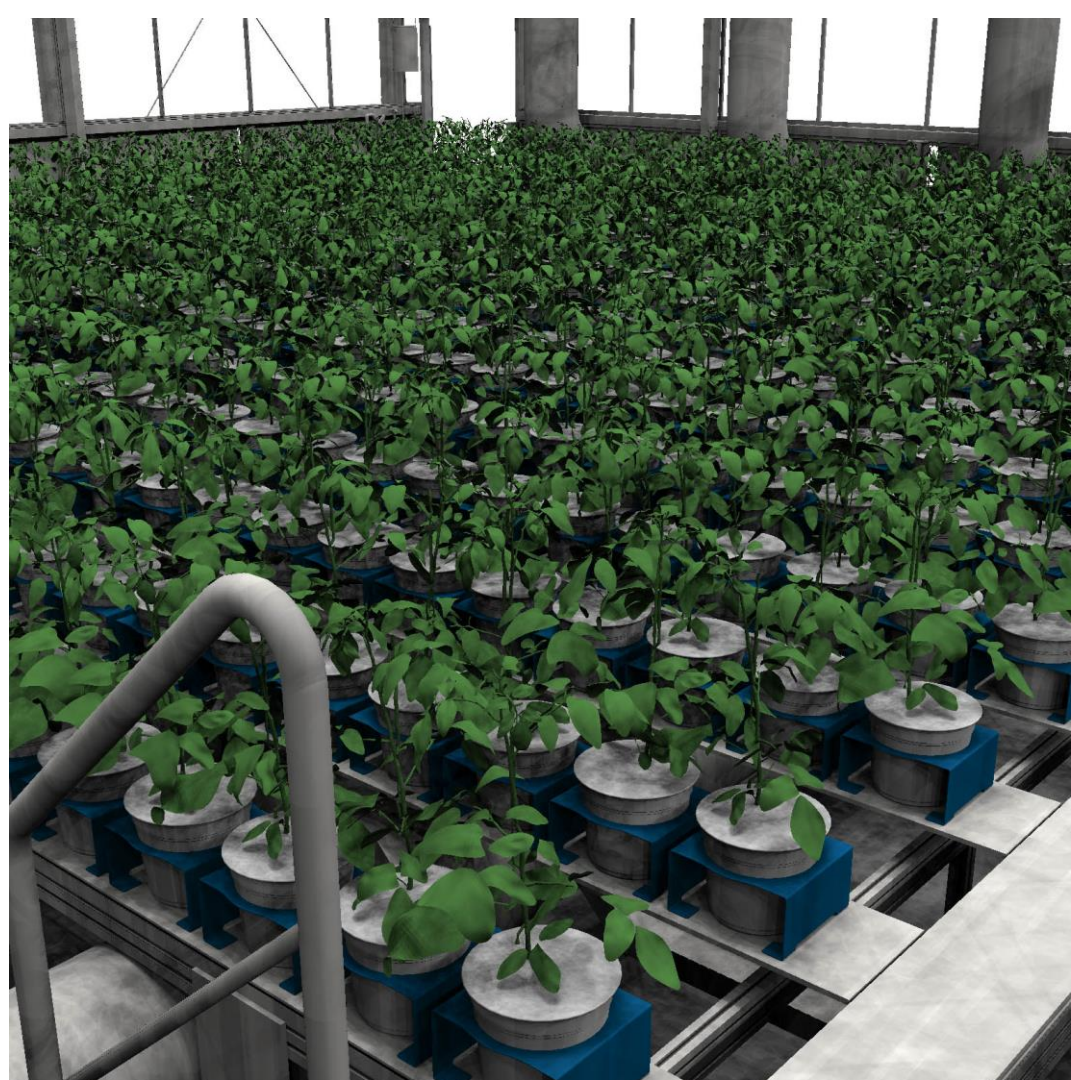
selRiobamba



Experiment in NPEC: Digital Twin VTC

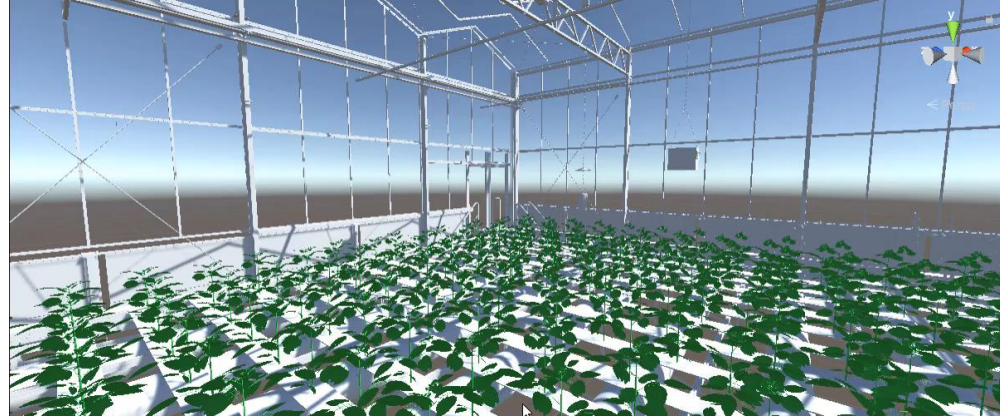




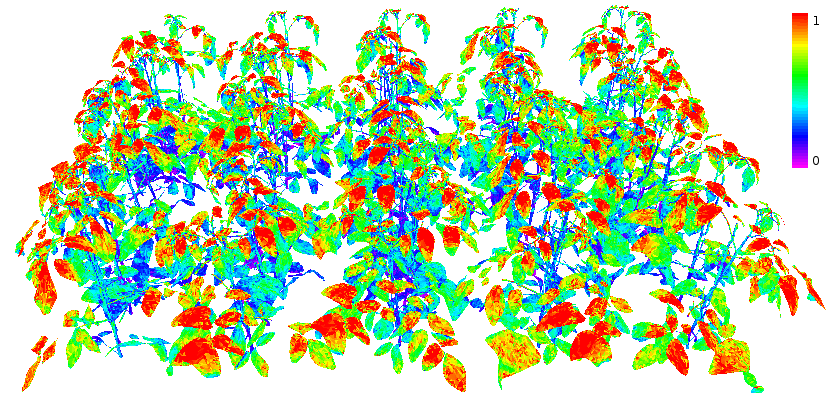
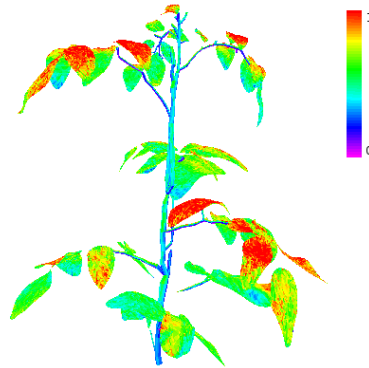


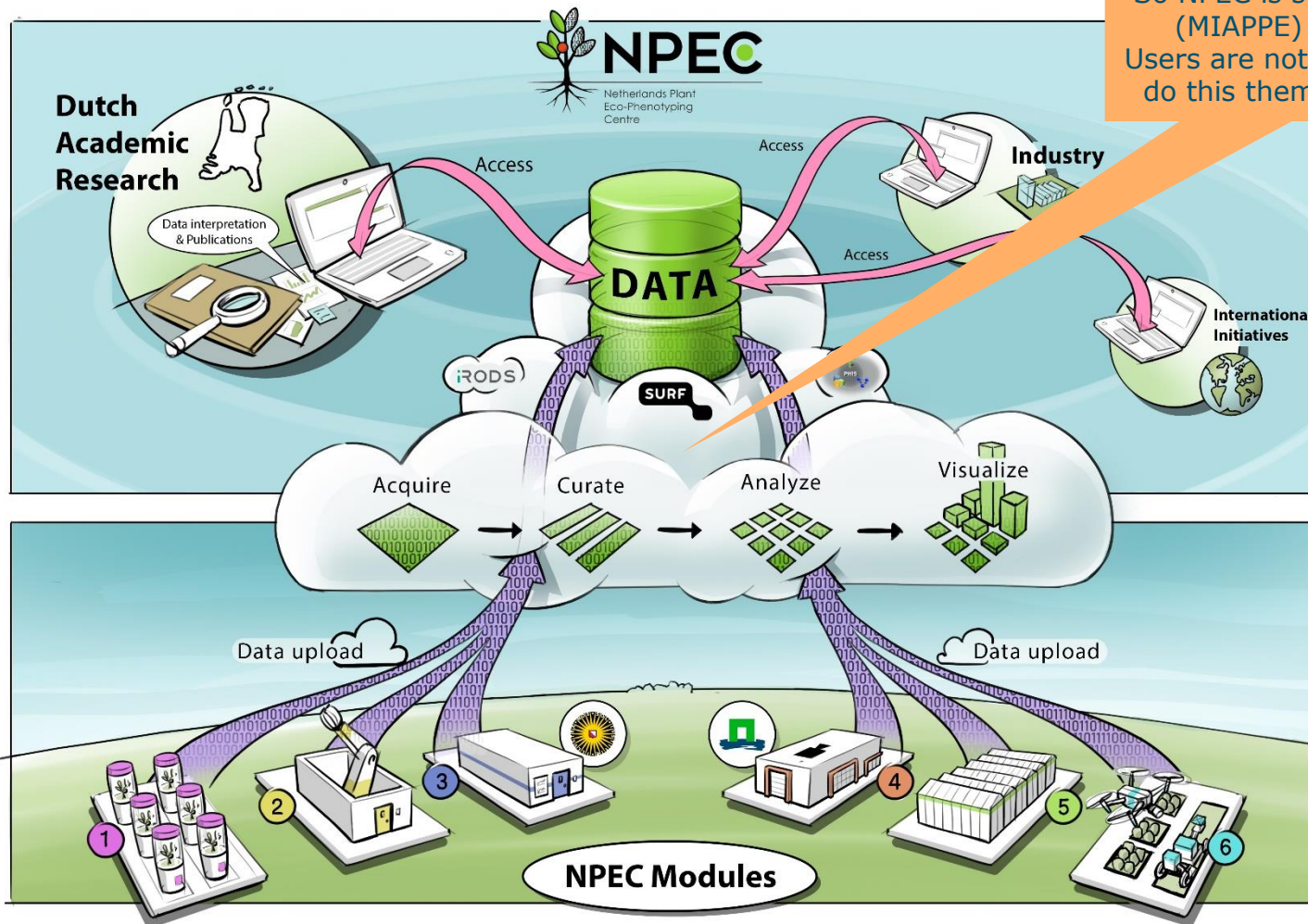
3D model – data interpretation with AI

3D data analysis Bolai XI



Light interception projection on 3D model (Katarina Streit)





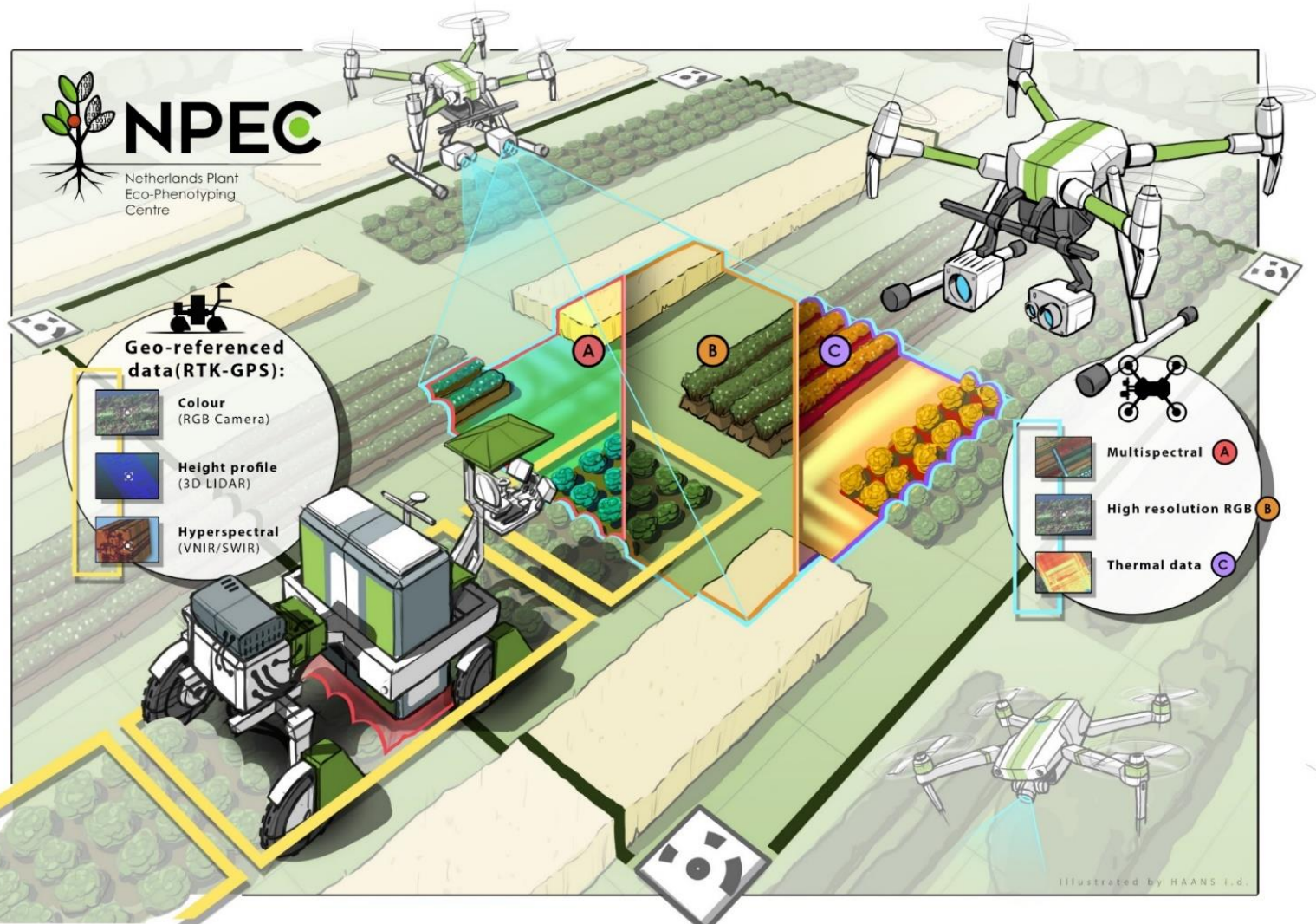
So NPEC is storing metadata (MIAPPE) for its users. Users are not motivated to do this themselves (often)!





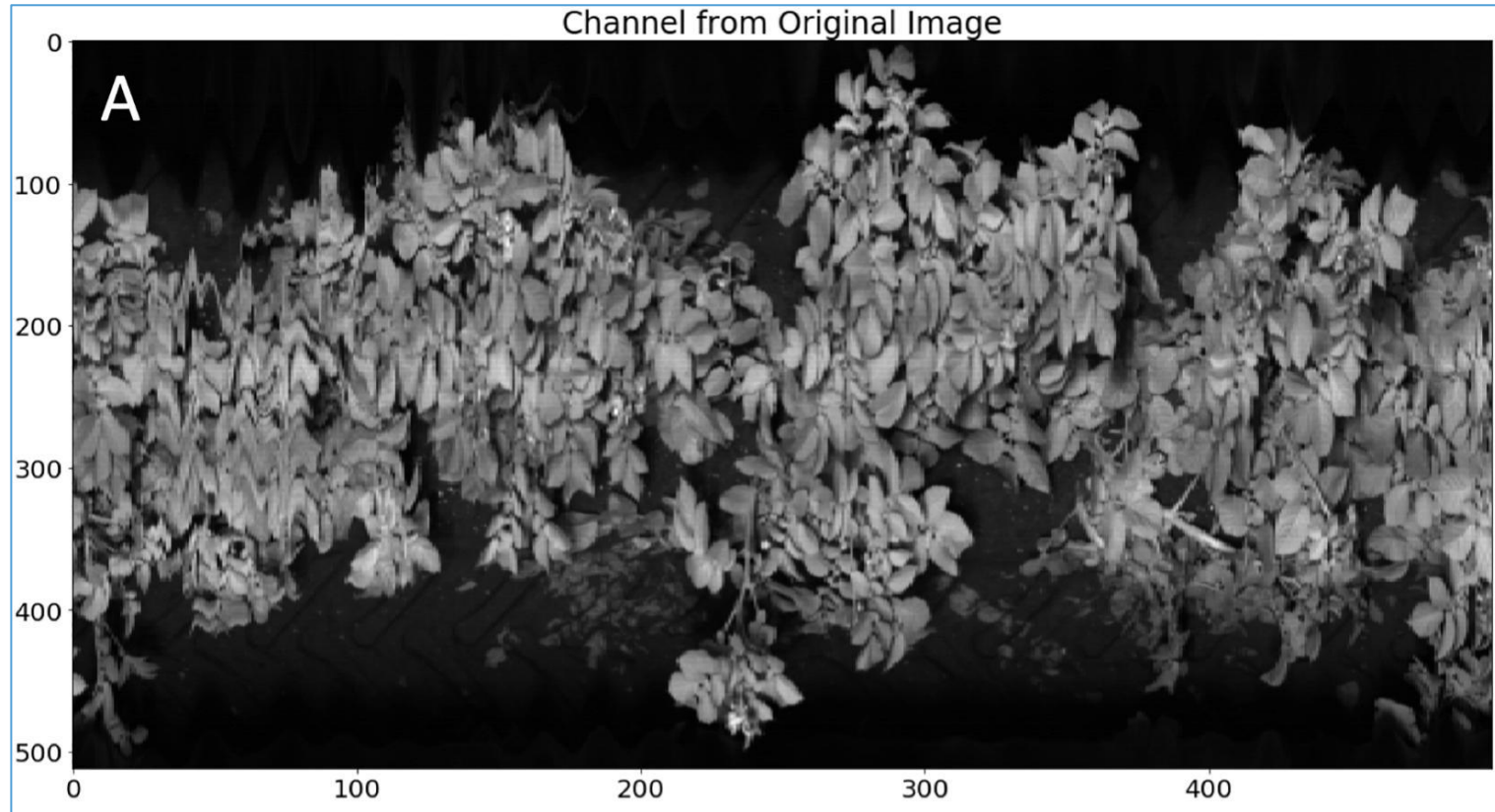
NPEC

Netherlands Plant
Eco-Phenotyping
Centre

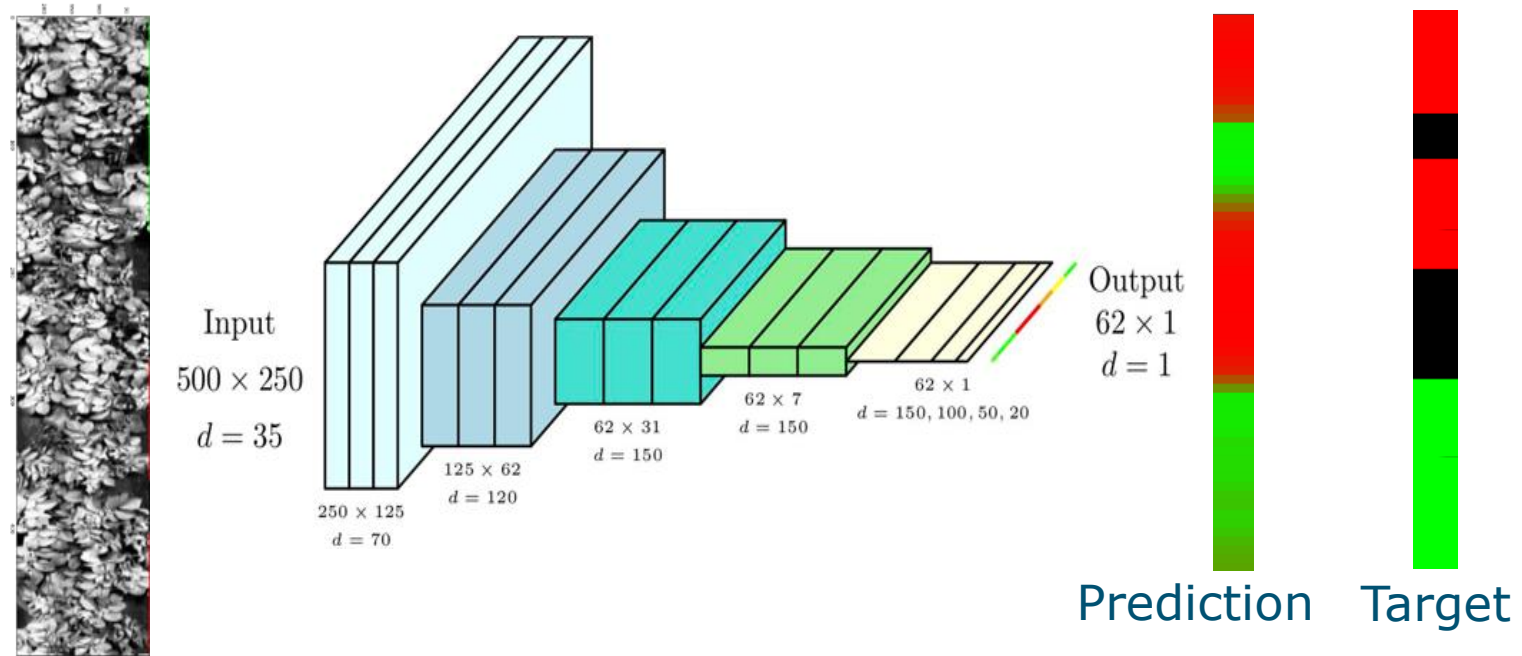


illustrated by HAANS i.d.

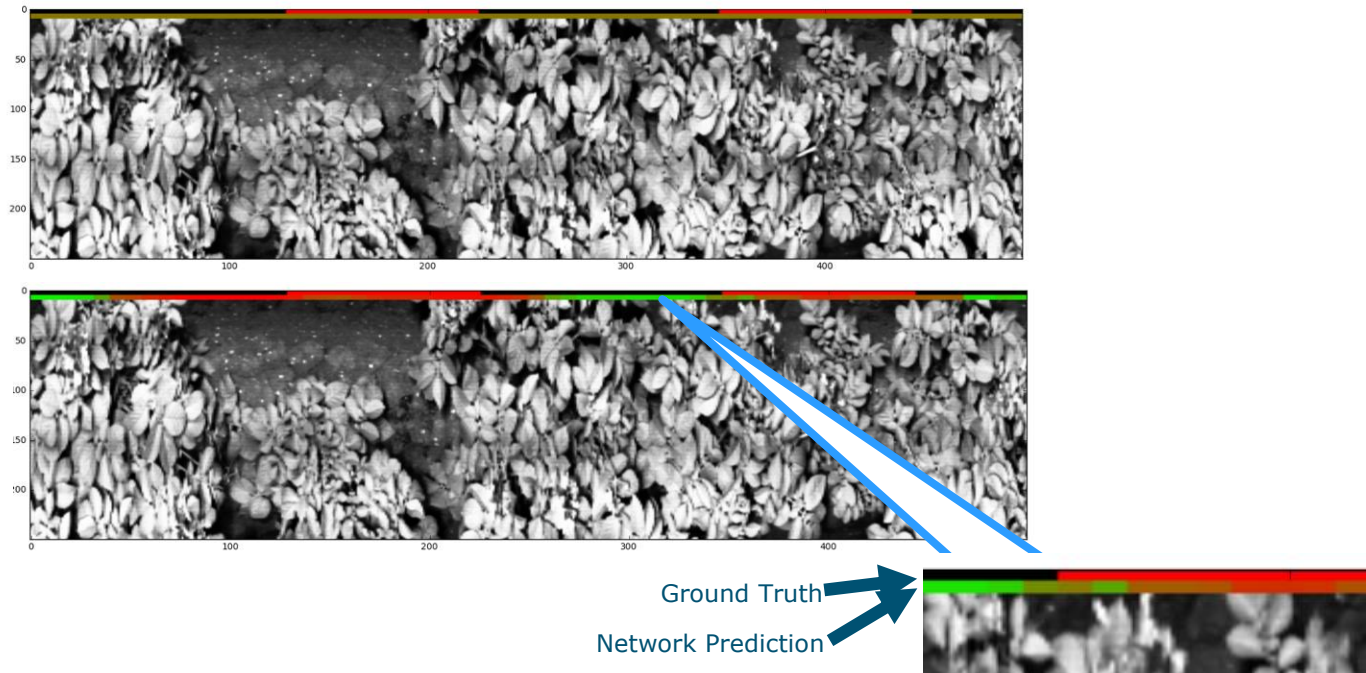
Disease detection on potato fields



Virus disease detection in seed potatoes



Virus disease detection in seed potatoes



Publication, dataset and article:

G. Polder, P.M. Blok, H.A.C. de Villiers, J.M. van der Wolf and J. Kamp, "Potato Virus Y Detection in Seed Potatoes Using Deep Learning on Hyperspectral Images", *Front. Plant Sci.* **10**, 582 (2019). doi: <http://dx.doi.org/10.3389/fpls.2019.00209>

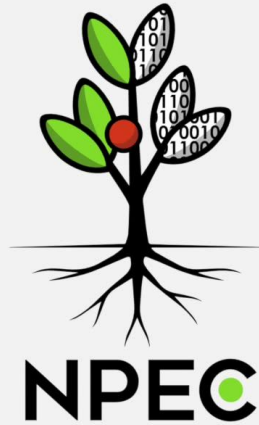
Data underlying the publication: Potato Virus Y Detection in Seed Potatoes Using Deep Learning on Hyperspectral Images
[10.4121/uuid:b1f7853c-f52b-4f33-bb06-a6539c7a45a4](https://doi.org/10.4121/uuid:b1f7853c-f52b-4f33-bb06-a6539c7a45a4)



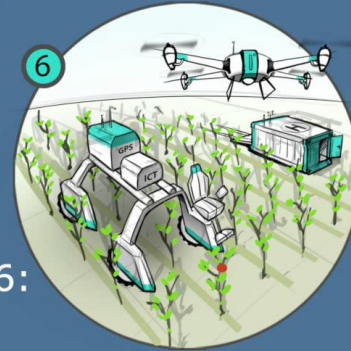


NPEC – TraitSeeker™

Netherlands Plant Eco-phenotyping Centre



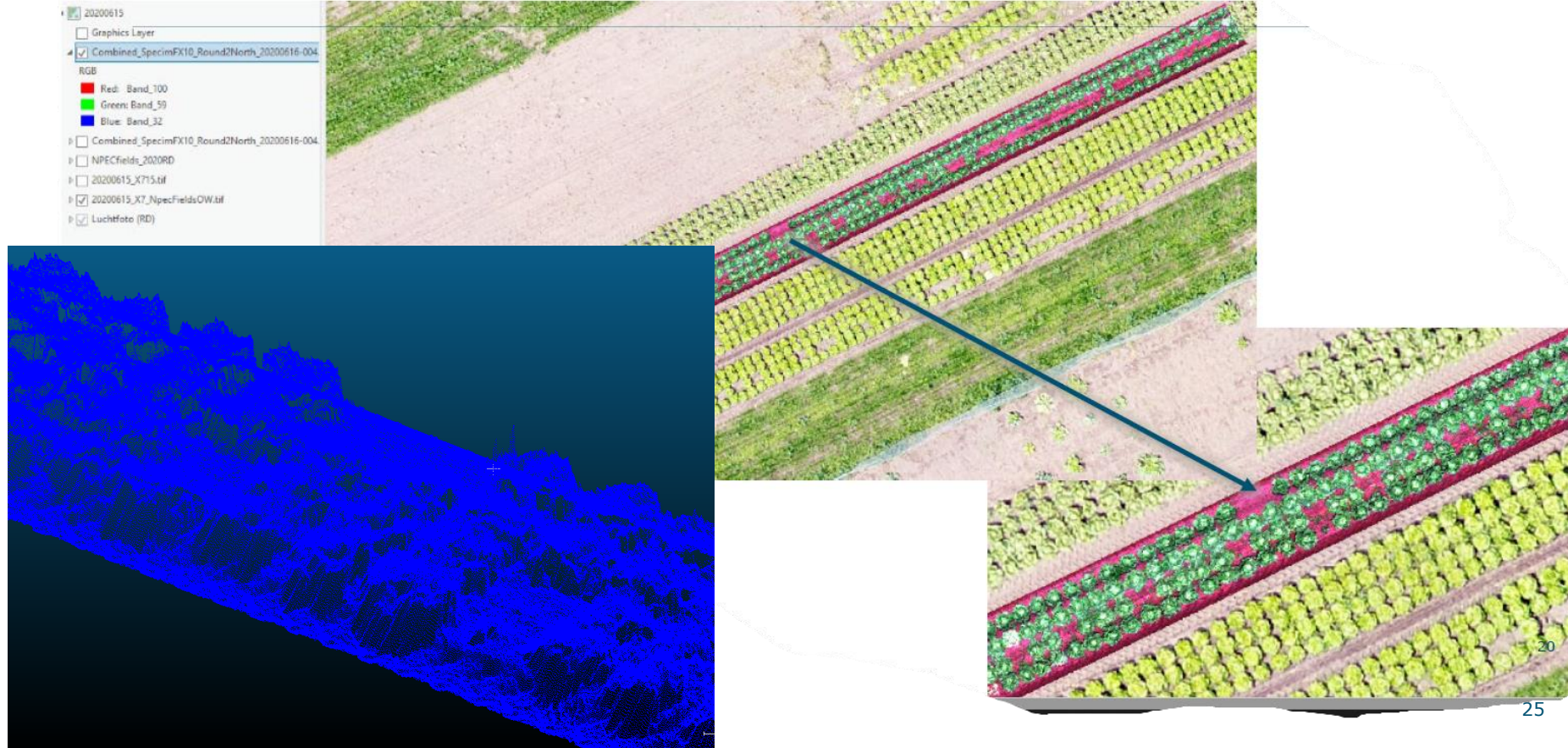
NPEC Module 6:
Open Field



Metadata implementation (MIAPPE)

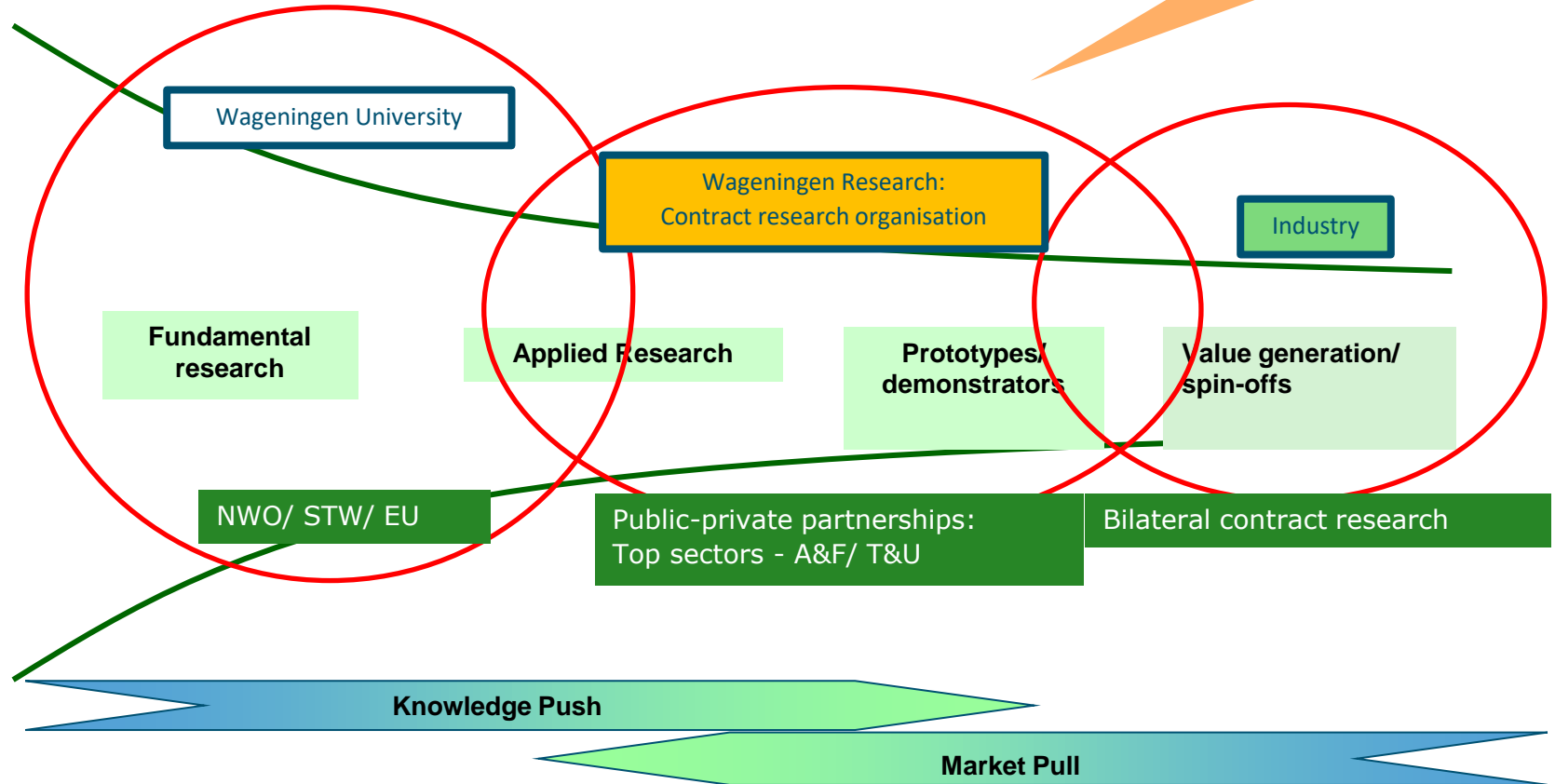
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Fusing drone data with TraitSeeker vehicle data:



WUR/ NPEC – Way of working/

NPEC data ownership:



26 – 30 sept 2022 – www.IPPS7.org



7TH INTERNATIONAL PLANT PHENOTYPING SYMPOSIUM | WAGENINGEN, NETHERLANDS

Incl. official opening of NPEC! You are all invited to come!

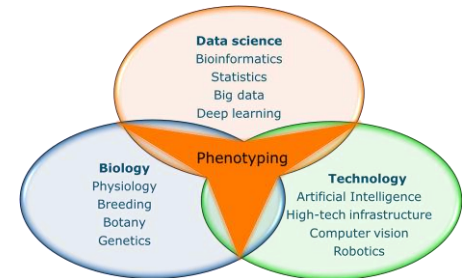
Summing up/ future work

Our mission:

To measure, understand and predict plant quality developments in climate rooms, greenhouses and on fields!

- Setup new research projects (EU/ PPS/ bilateral)
- Offer access to novel phenotyping tools (NPEC)
- Explore potential of large scale research infrastructure for plant phenotyping.

NB: Our different backgrounds :



Questions/ ideas?

More info: www.npec.nl

Thanks to:

Mark Aarts, Rene Klein Lankhorst, Peter Roos, Sven Warris, Tim van Daalen, Christine Staiger, Jannick Verstegen, David Brink, Rinie Verwoert, Tom Theeuwen, Corne Pieterse, George Kowalchuk, etc. etc.

