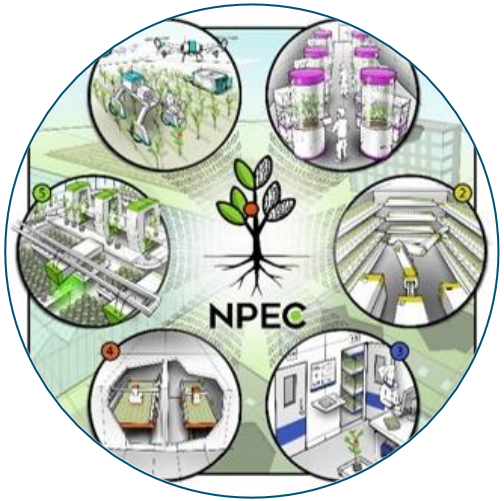
Netherlands Plant Eco-phenotyping Centre (NPEC)

Measuring and understanding plants to improve performances

Rick van de Zedde – March 29th 2022 Ghent



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CROP INNOVATION & BUSINESS
March 27-29, 2022 | Ghent, Belgium

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.

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Contact: rick.vandezedde@wur.nl

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 !

Wageningen UR - campus

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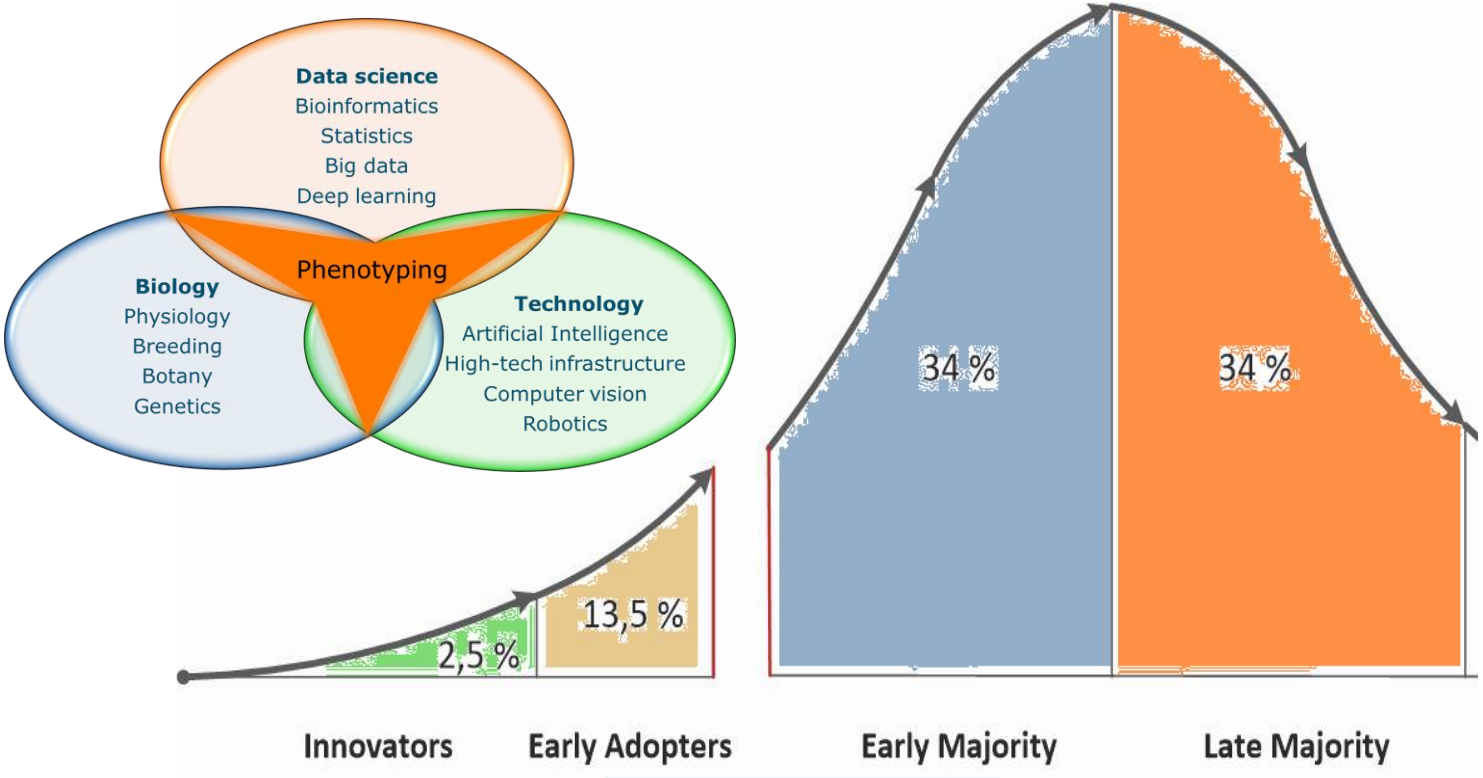
Phenotyping – a multi-disciplinary domain



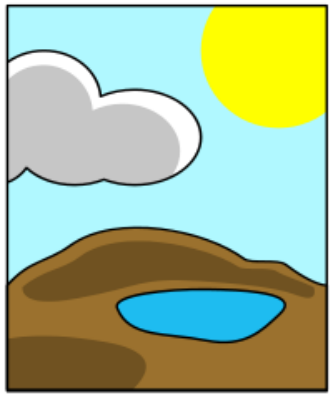
Technology adoption life cycle

https://en.wikipedia.org/wiki/Technology_adoption_life_cycle

Genotype ≠ phenotype

Genotype

+



Environment

NPEC

=

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

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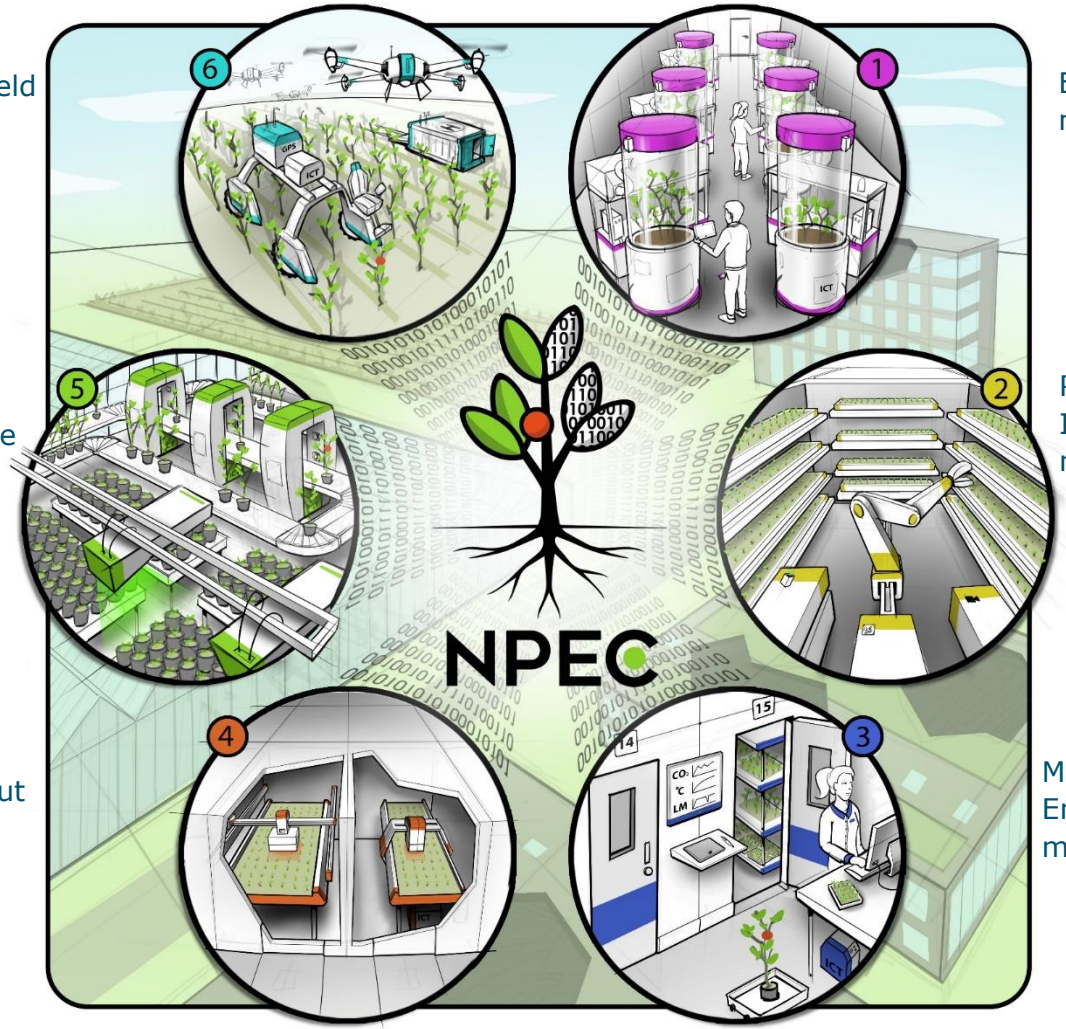

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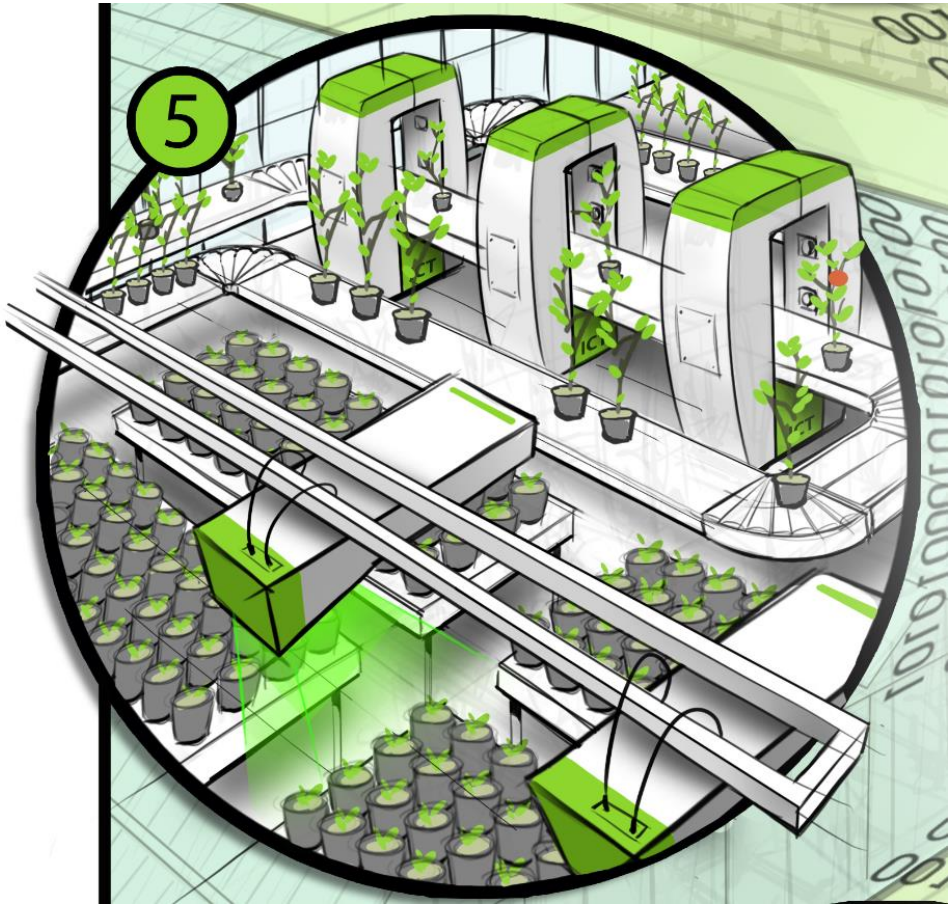

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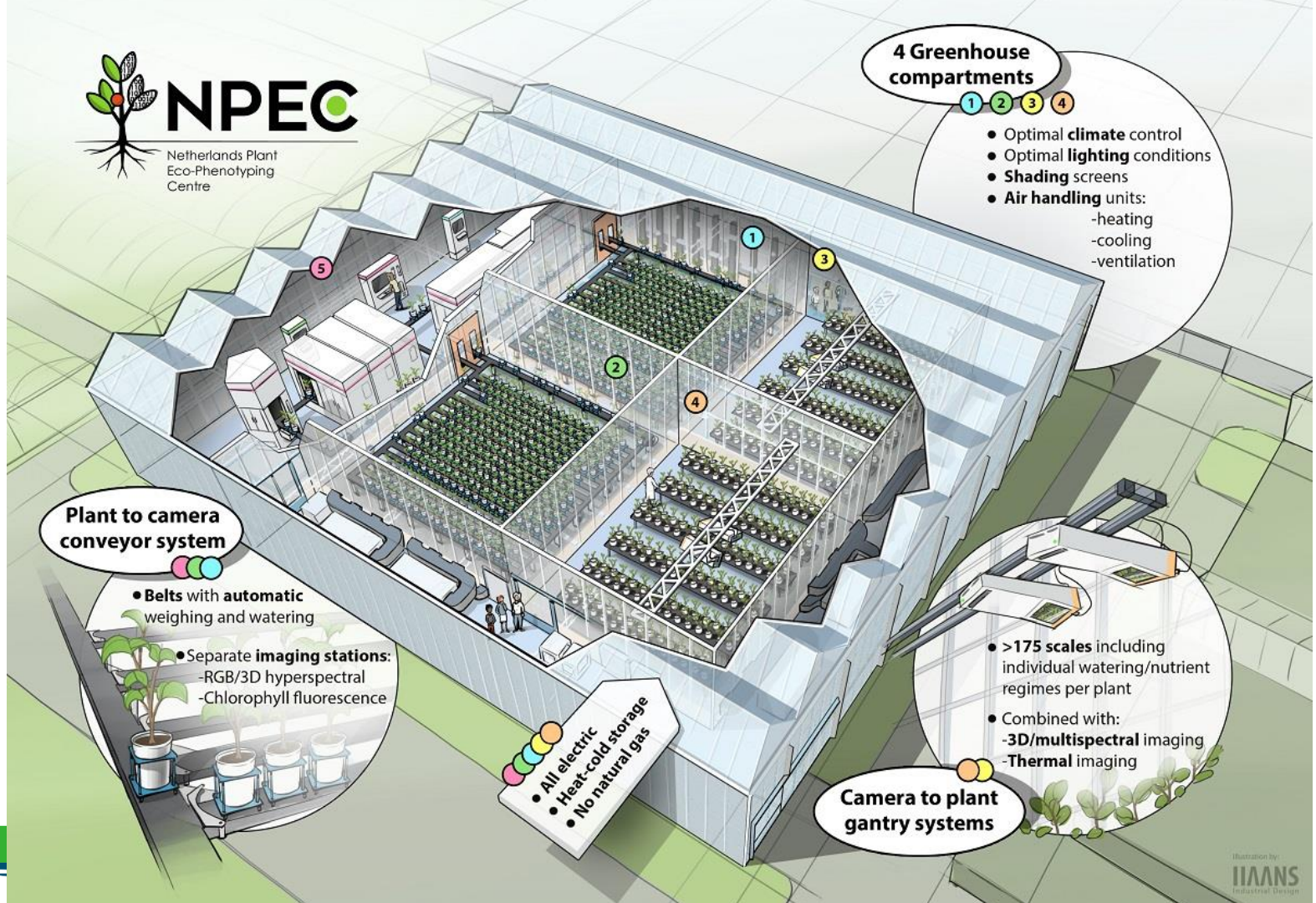
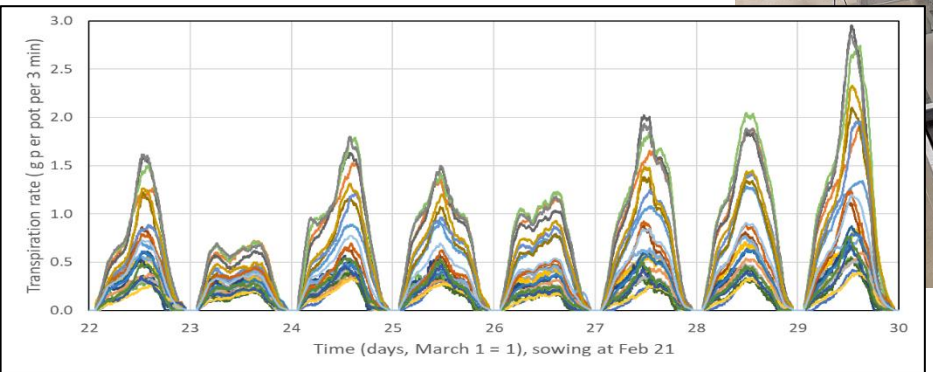

NPEC
Netherlands Plant Eco-Phenotyping Centre
4 Greenhouse compartments
1 2 3 4
• Optimal **climate** control
• Optimal **lighting** conditions
• **Shading** screens
• **Air handling** units:
-heating
-cooling
-ventilation
1
2
3
4
5
Plant to camera conveyor system
• **Belts** with **automatic** weighing 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
Illustration by:
IIAANS
Industrial Design

Impressions: Quinoa drought stress



NPEC publication:

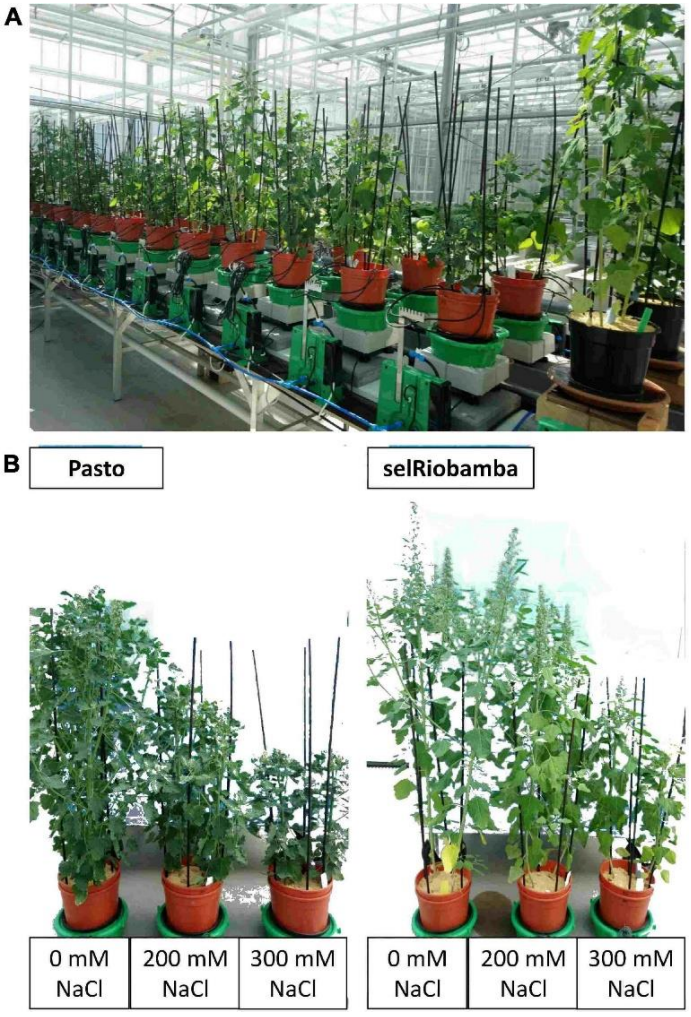
frontiers in Plant Science

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

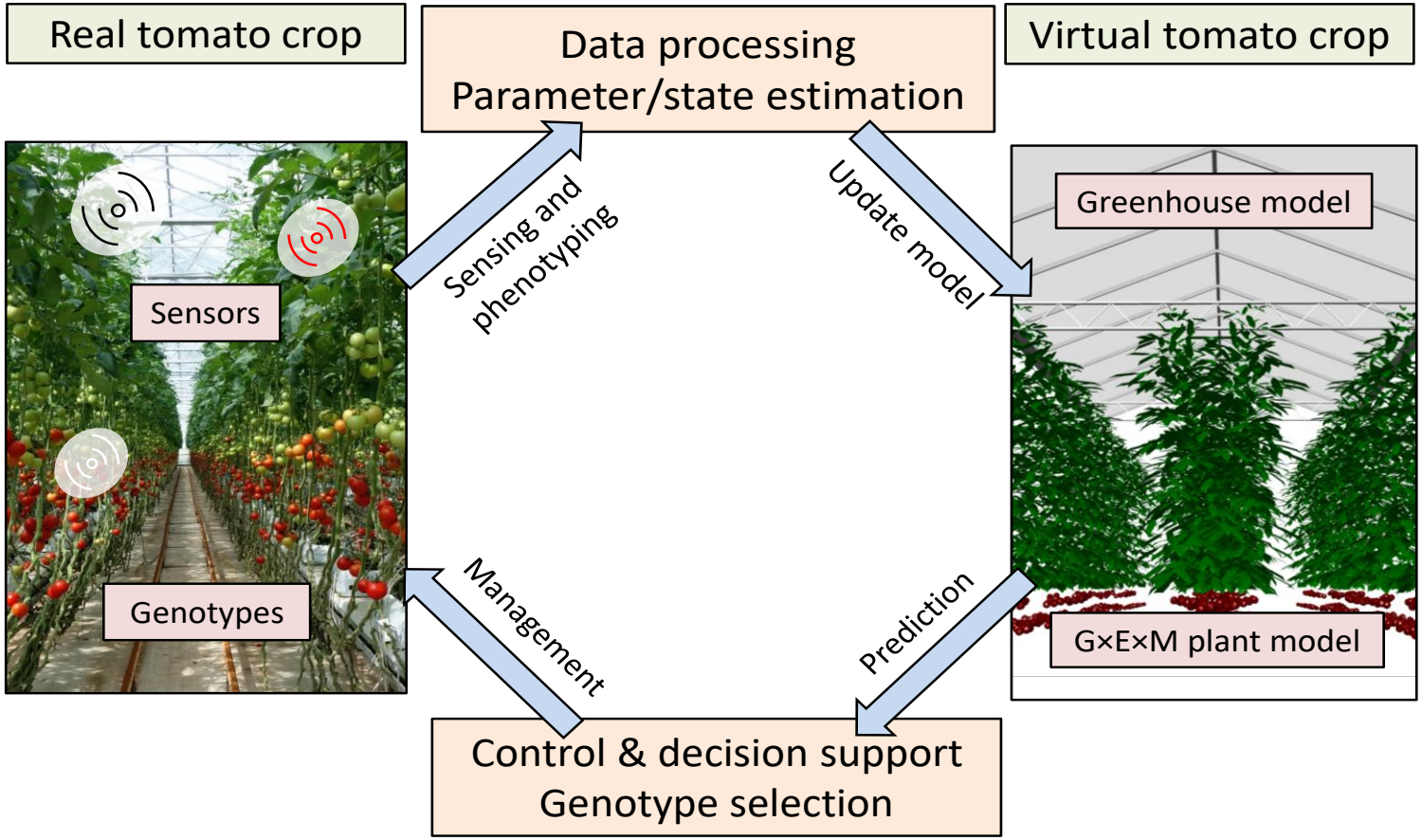
Viviana Jaramillo Roman[1,2†], Rick van de Zedde[3], Joseph Peller[3], Richard G. F. Visser[1], C. Gerard van der Linden[1] and Eibertus N. van Loo[1*]

[1]Plant Breeding, Wageningen University and Research, Wageningen, Netherlands
[2]Graduate School Experimental Plant Sciences, Wageningen University, Wageningen, Netherlands
[3]Wageningen Plant Research, Wageningen, Netherlands

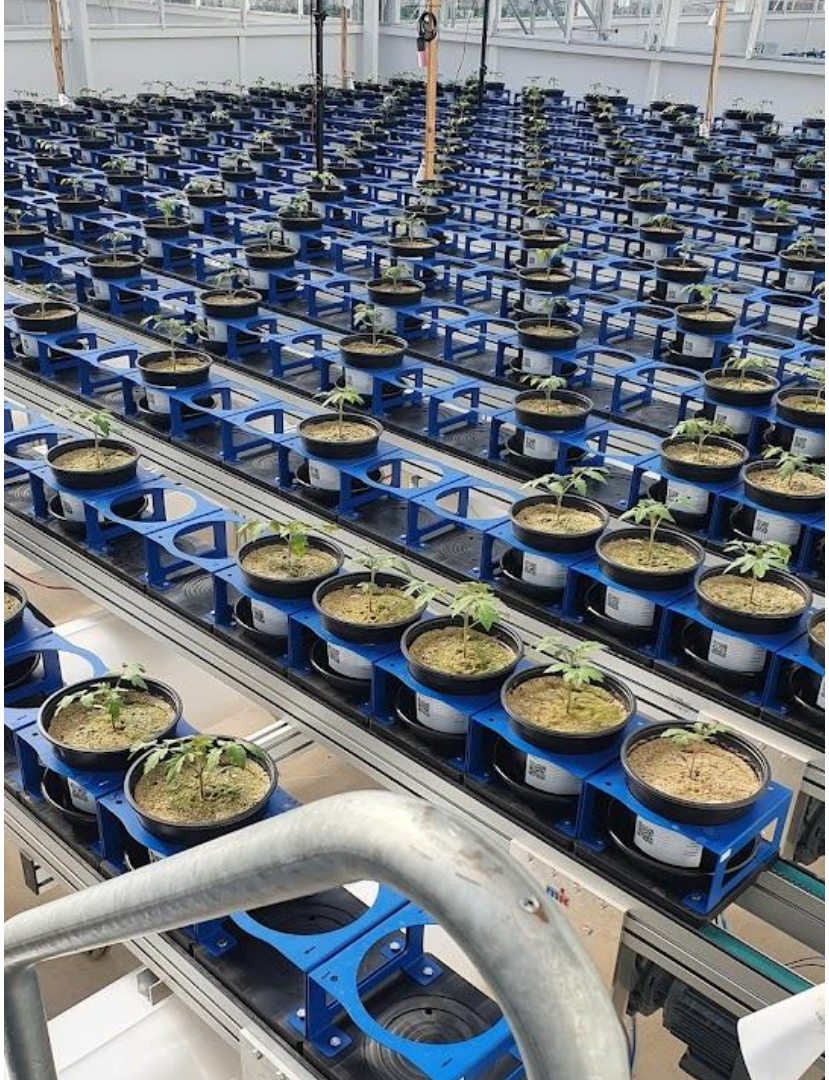
Front. Plant Sci., 05 August 2021
| https://doi.org/10.3389/fpls.2021.634311



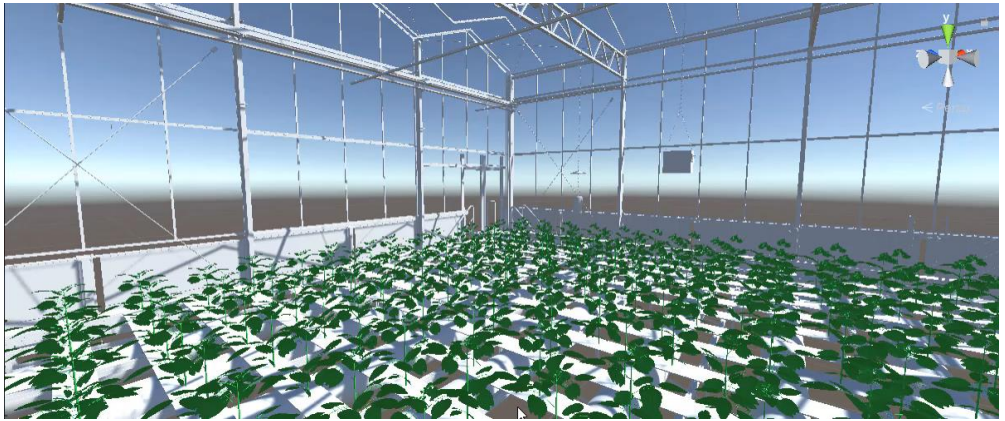
Experiment in NPEC: Digital Twin VTC



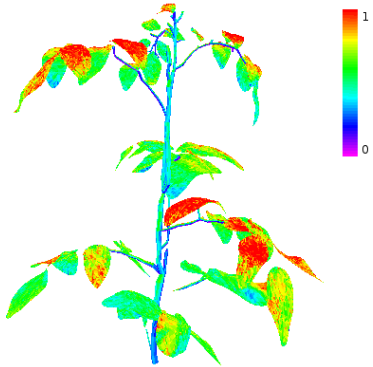

Wat

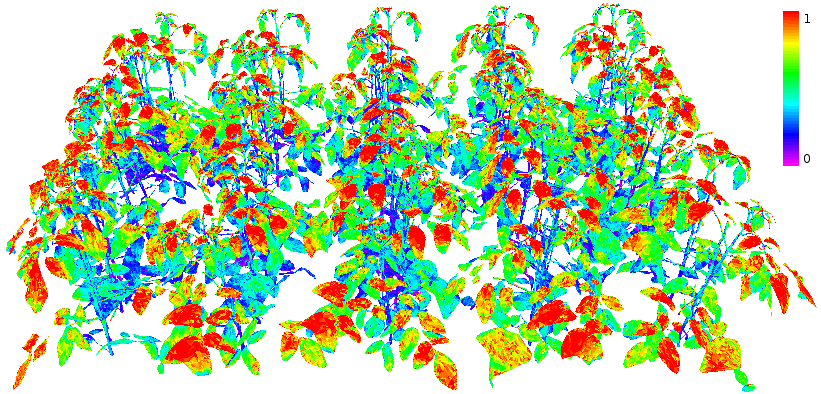


3D model – data interpretation with AI

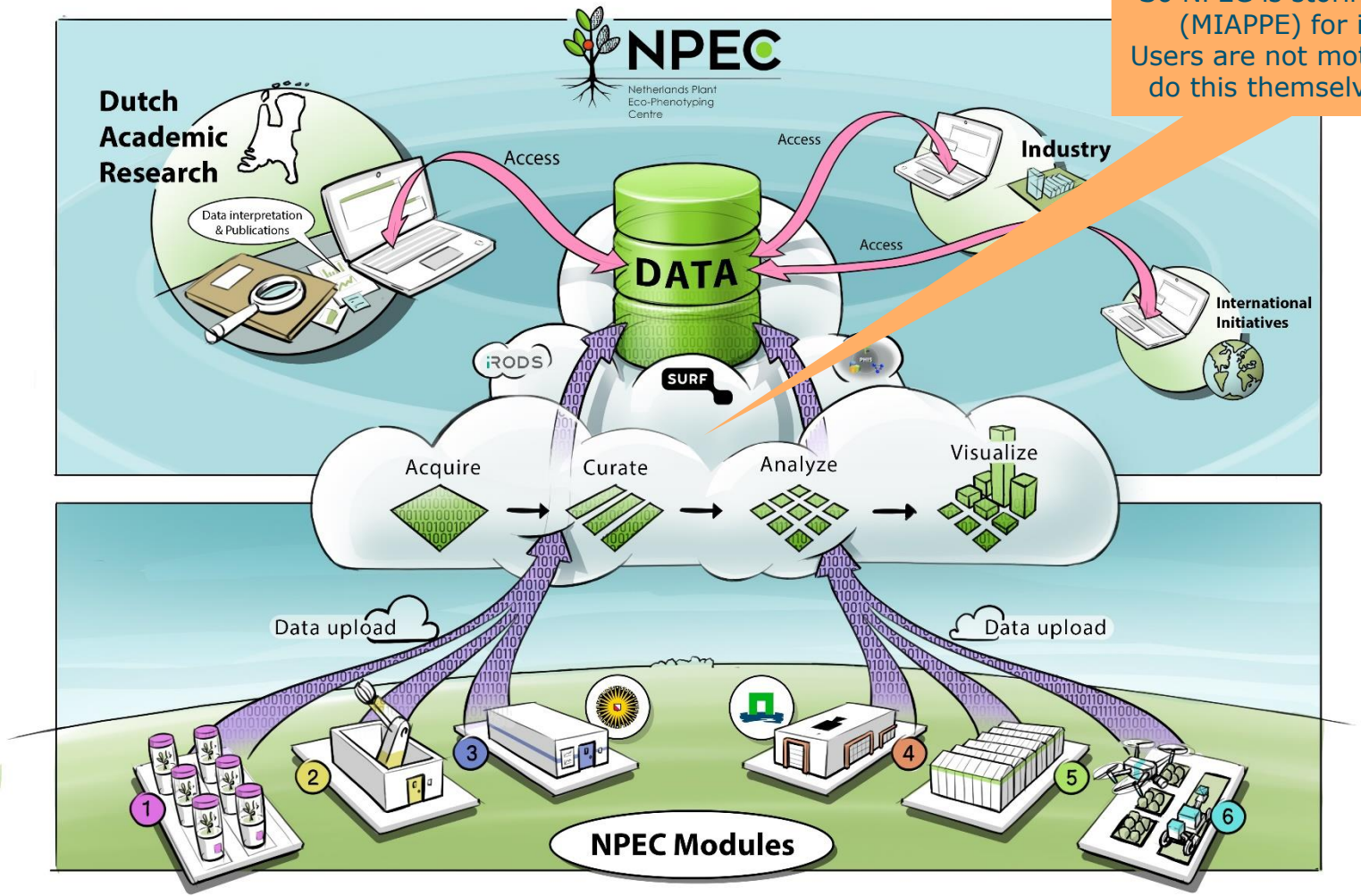


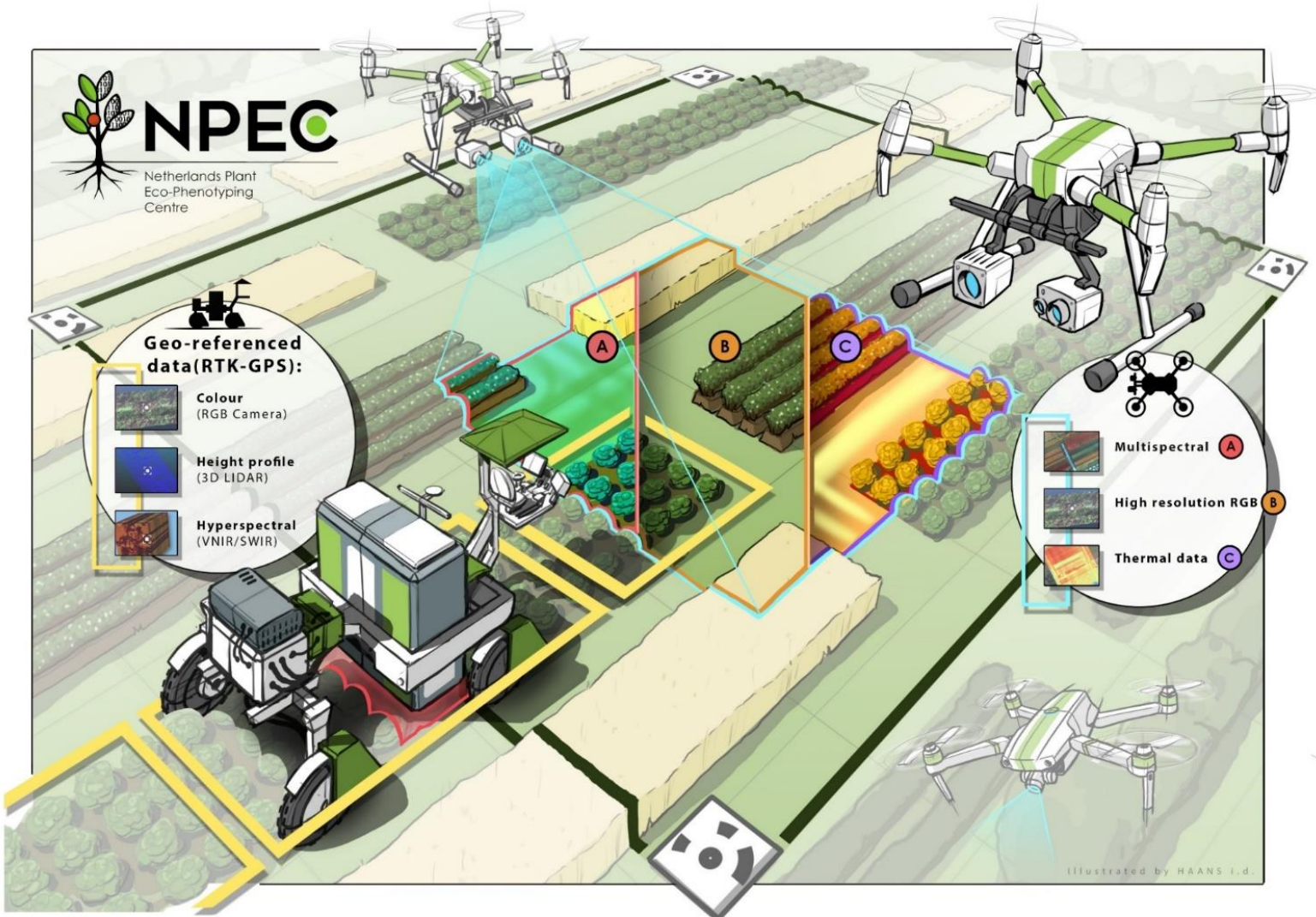
Light interception projection on 3D model (Katarina Streit)



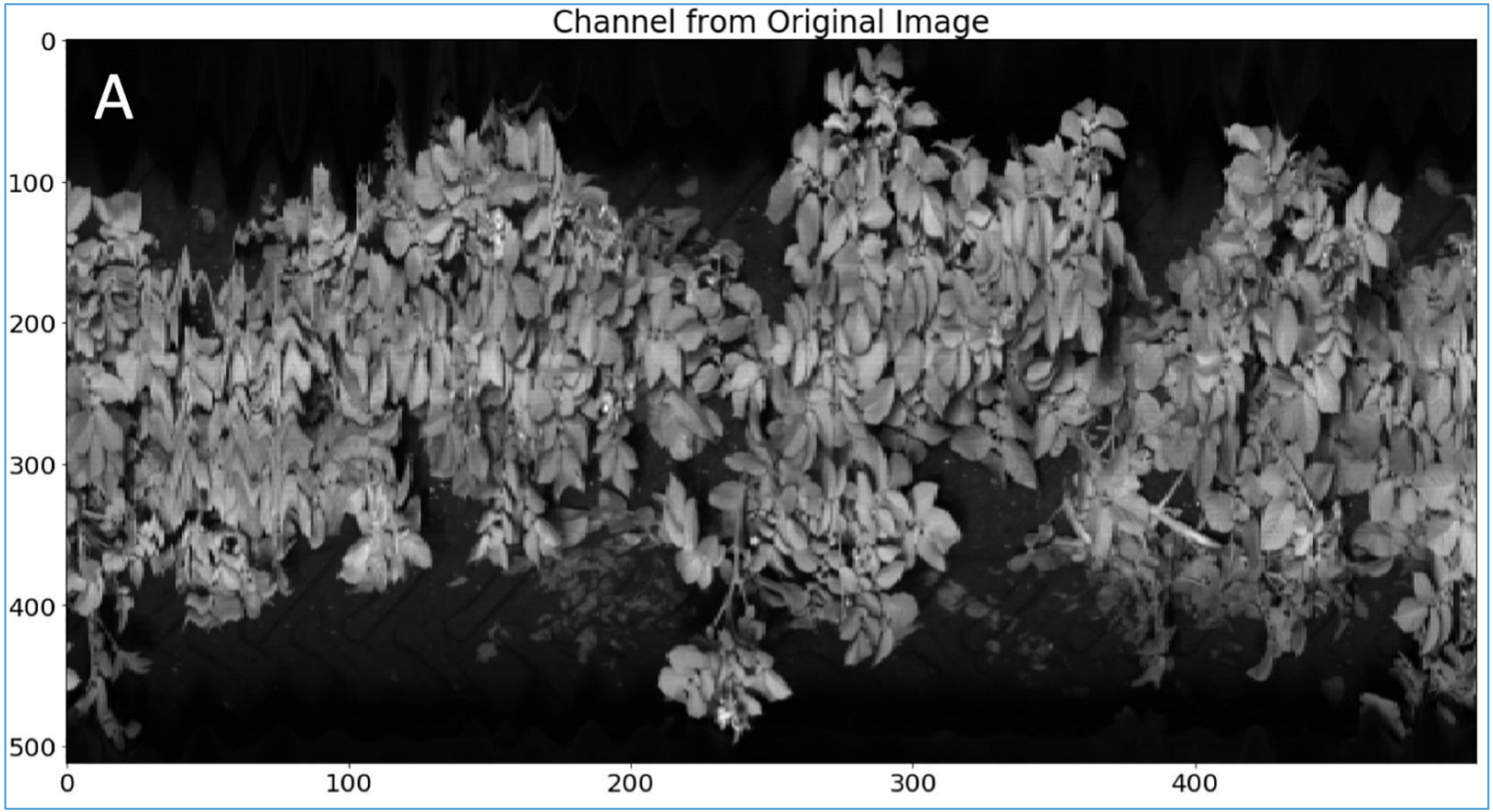


So NPEC is storing metadata (MIAPPE) for its users. Users are not motivated to do do this themselves (often)!




NPEC
Netherlands Plant
Eco-Phenotyping
Centre
Geo-referenced
data(RTK-GPS):
Colour
(RGB Camera)
Height profile
(3D LIDAR)
Hyperspectral
(VNIR/SWIR)
A
B
C
Multispectral A
High resolution RGB B
Thermal data C
illustrated by HAANS i.d.

Disease detection on potato fields



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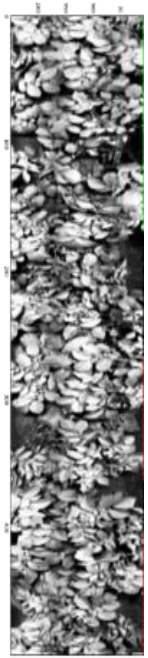
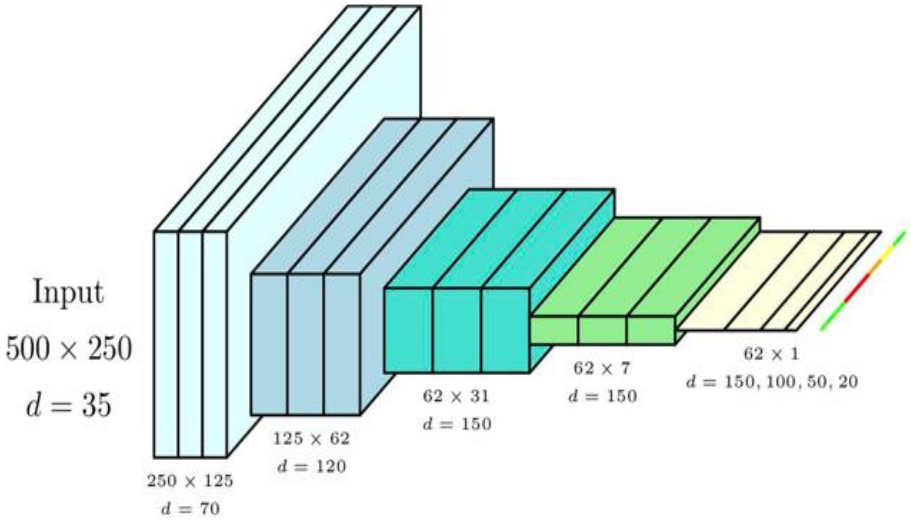
Gerrit Polder – Hyperspectral Imaging
Hendrik de Villiers – Deep learning

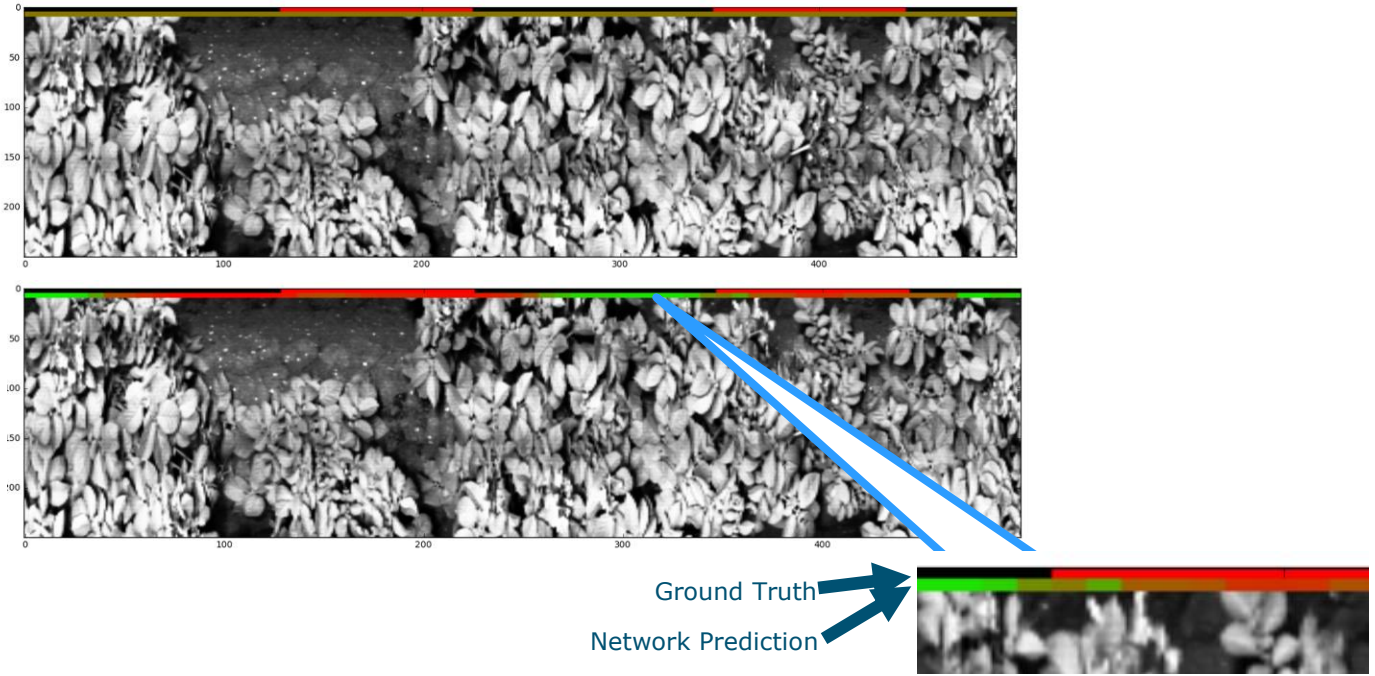
Virus disease detection in seed potatoes





Prediction Target

Virus disease detection in seed potatoes



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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

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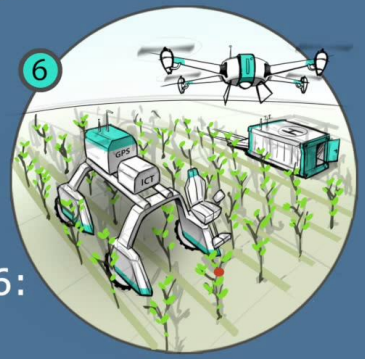
FieldExplorer
NPEC

NPEC – TraitSeeker™

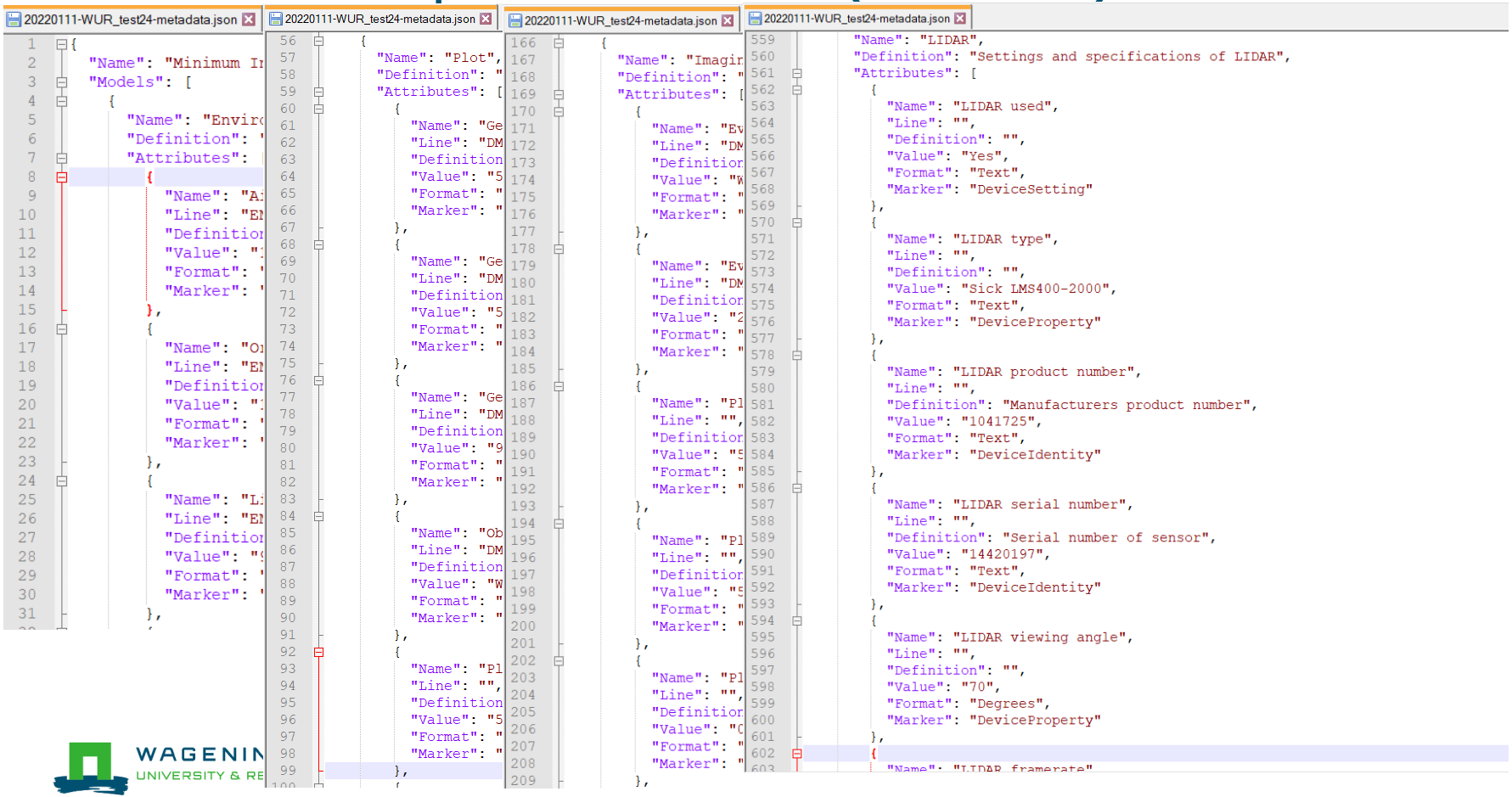
Netherlands Plant Eco-phenotyping Centre

NPEC

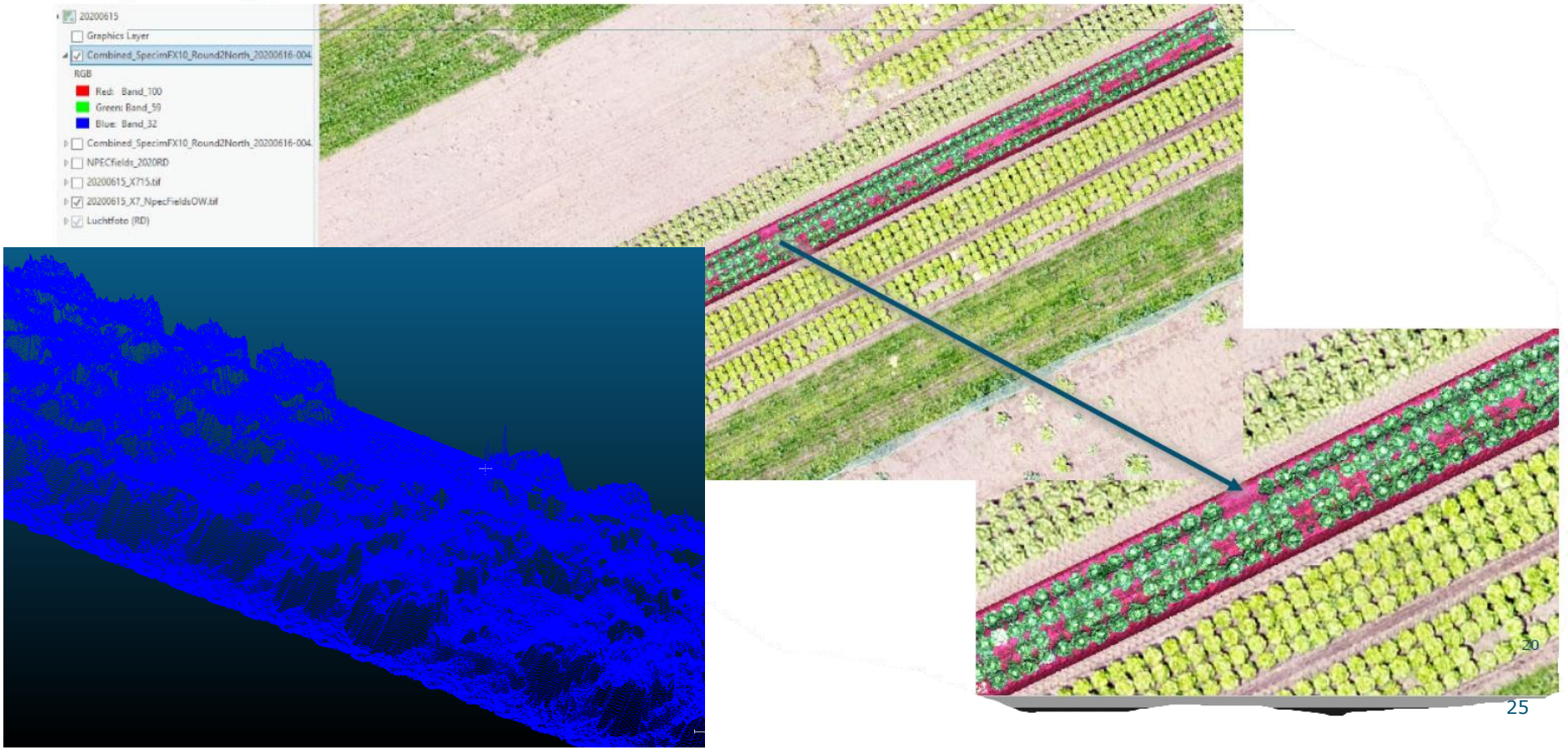
NPEC Module 6:
Open Field



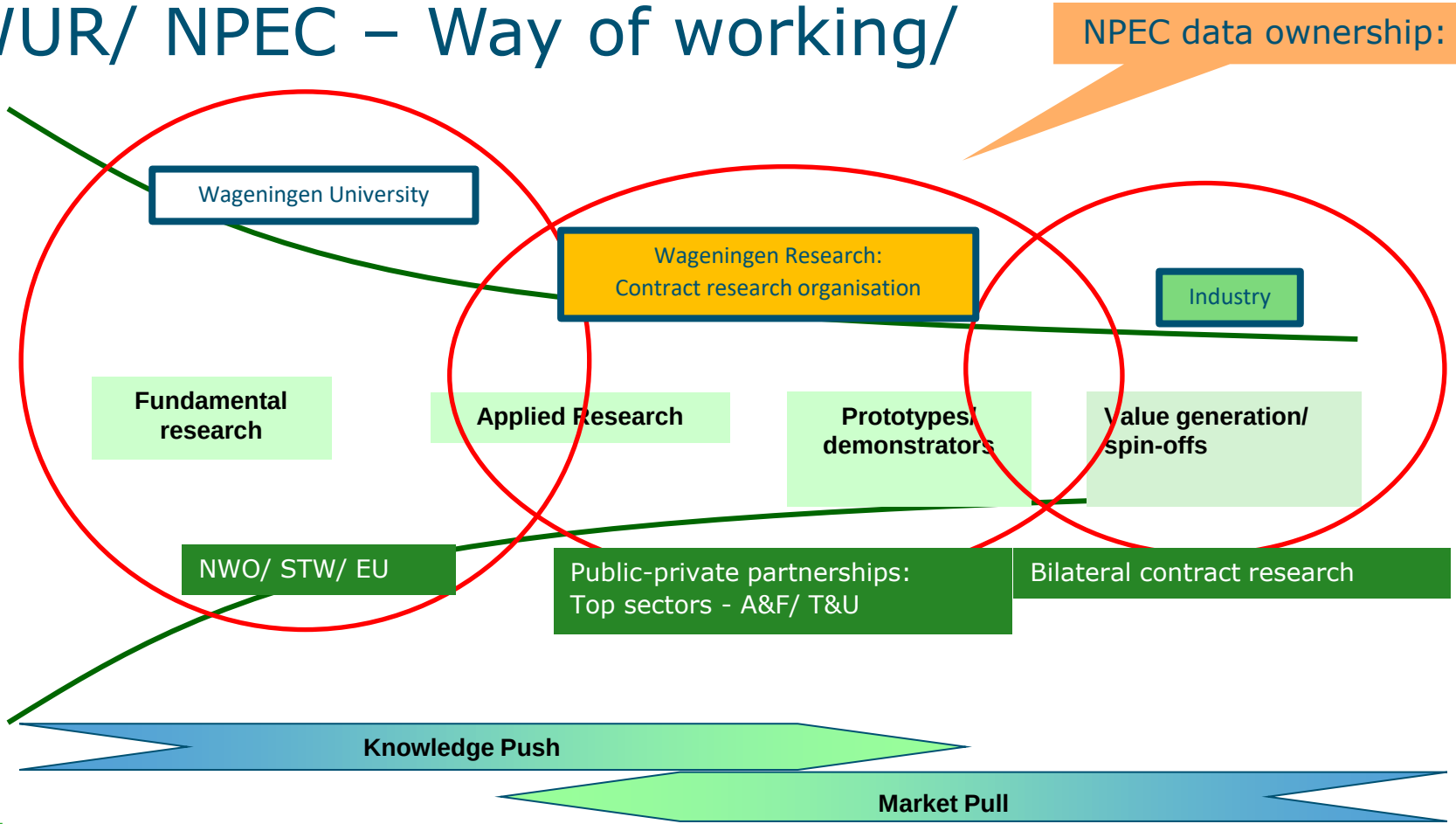
Metadata implementation (MIAPPE)



Fusing drone data with TraitSeeker vehicle data:



WUR/ NPEC – Way of working/



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26 – 30 sept 2022 – www.IPPS7.org

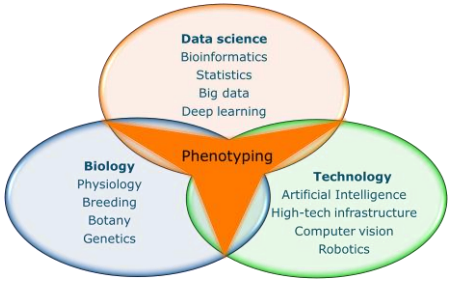
Incl. official opening of NPEC! You are all invited to come!

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 :

let's explore collaboration!

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Contact: rick.vandezedde@wur.nl

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.