

Technical Working Party on Testing Methods and Techniques**TWM/4/8 Add.****Fourth Session****Original:** English**Cambridge, United Kingdom, June 2 to 5, 2026****Date:** June 15, 2026

**ADDENDUM TO:
PHENOTYPING AND IMAGE ANALYSIS AT NAKTUINBOUW***Document prepared by an expert from the Netherlands (Kingdom of)**Disclaimer: this document does not represent UPOV policies or guidance*

The annex to this document contains a presentation “Phenotyping and image analysis at Naktuinbouw”, made by an expert from the Netherlands (Kingdom of), at the fourth session of the TWM.

[Annex follows]



1

- **Long-term Vision:**
 - Automation, Innovation & Digitalization serve as a means to increase quality & efficiency
 - Create supporting systems to help navigate challenges in near future (labor shortage/knowledge gaps/costs)
 - Try to understand if we need totally different solutions to the way we do Identity Testing
- **Mid-term Goals:**
 - Make our primary processes more efficient
 - Understand data & Infrastructure readiness for future High-throughput Phenotyping Projects
 - **Establish Data & Process Standards**
 - On-board, disseminate, educate colleagues on how to be data-ready, highlight gaps in processes
- **Immediate Project Goals:**
 - For Several Processes, we already have data as a part of the process: Image Data
 - This is the quickest and easiest point to start with to have the discussions
 - What are the characteristics difficult to measure in an automated way? What are the issues with metadata? What are the bottlenecks?

2

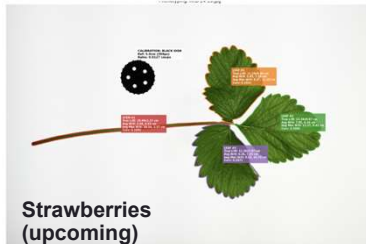
2

Tools to find similar varieties in Ornamentals



Two immediate case studies to see if AI/CV helps in automation

Morphological characteristics of leaves & other organs



3

3



This is how our variety collection looks like. Different categories on size of the lips, colors, presence of stripes/spots or both, over color, color of lips are present. These DUS descriptions/annotations are considered as labels/metadata in our pipeline

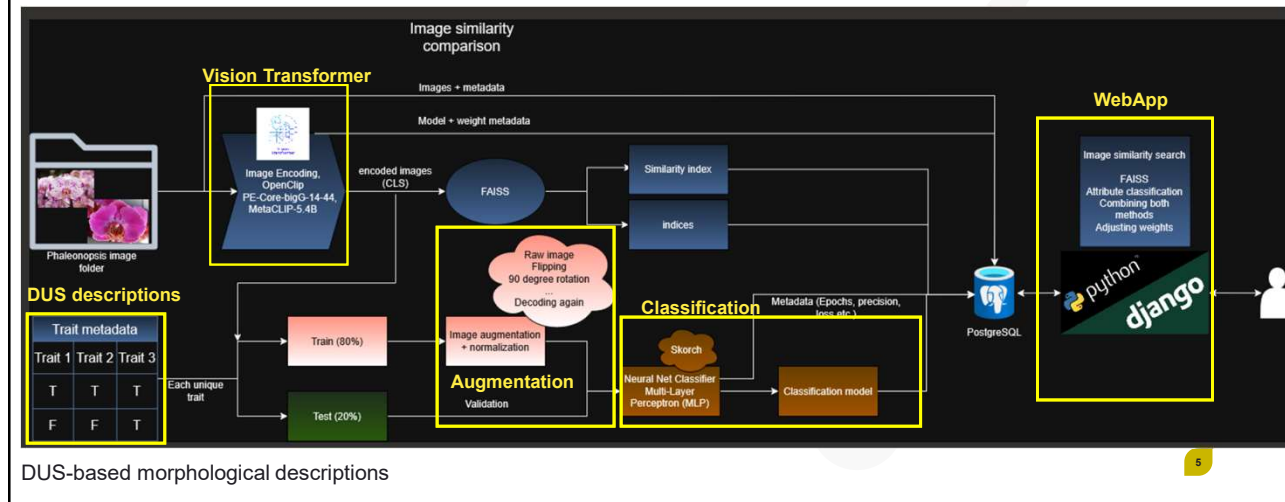
Assumptions

- The variety collection was a digital representation of a real world data, it was not specifically meant for AI
- Categories/groups had unequal representations (some had too few)
- Rulers were not uniformly included, we could not use it for calibration
- Background was not consistent, shadows present
- The DUS descriptions obviously has approximations -> converted to scales

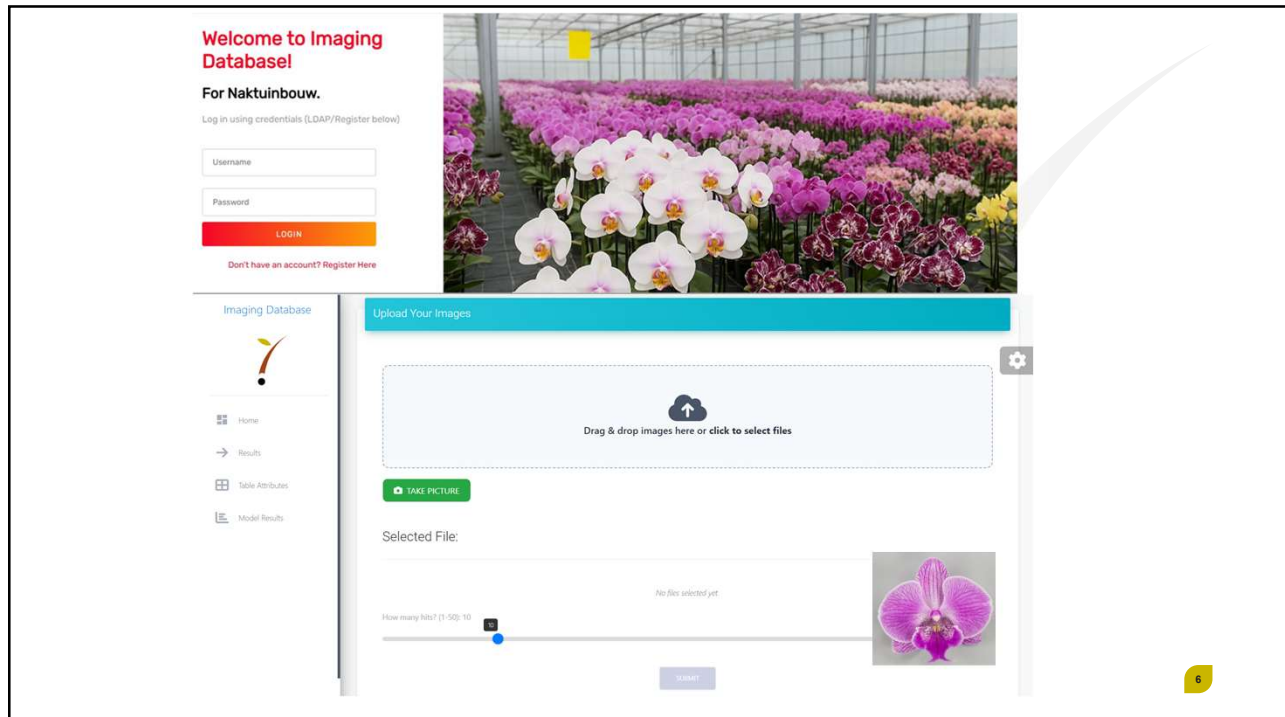
4

4

Computational Workflow:




5




6

Computational framework to capture the results, validate/annotate by DUS examiner

Related image: ops2029-blm.jpg (raw_images/ops2029-blm_MXD46V1.jpg)



Related image: ops1546-blm.jpg (raw_images/ops1546-blm_d18Q1P13.jpg)



Current batch hits
Easily browse the images related to your hit, sorted by similarity.

Screenshot 2025-10-08 16:39:17.png_attributes General model hits

Search:

Attribute Name	Attribute Value	Precision	Selected
lip_structure	biglip	100.00%	true
pattern_detail	NA	100.00%	true
Petal_breedite_deel	basis	100.00%	true
petalen_rakend	vrij	100.00%	true
Dispaal_netting_afwez_kaarwez	kaarwez	100.00%	true
Zijlob_netting_afwez_kaarwez	NA	100.00%	true
Lepaal_spots_afwez_kaarwez	kaarwez	100.00%	true
Zijlob_strepen_afwez_kaarwez	NA	100.00%	true
Eindlob_netting_afwez_kaarwez	kaarwez	100.00%	true
Snor	kaarwez	100.00%	true

Previous 1 2 3 4 5 6 8 Next

Similarity: 89.3954%

DL_ID: 4419

Comment

Add a comment

Is Hit/Validated

Search:

Name	Hit attribute	HP	QP	C...
Dispaal_breedite_d...	midden	100.00%	88.27%	✓
lip_structure	biglip	100.00%	100.00%	✓
pattern_detail	NA	100.00%	100.00%	✓
Eindlob_netting_af...	kaarwez	100.00%	100.00%	✓
Lepaal_spots_afwez...	kaarwez	100.00%	100.00%	✓
Petal_breedite_deel	basis	100.00%	99.10%	✓
petalen_rakend	vrij	100.00%	100.00%	✓
Petal_breedite_deel	basis	100.00%	100.00%	✓
Zijlob_strepen_afwez...	NA	100.00%	100.00%	✓
Zijlob_netting_afwez...	NA	100.00%	100.00%	✓

Previous 1 2 3 4 5 6 8 Next

Similarity: 88.9854%

DL_ID: 4419

Comment

Add a comment

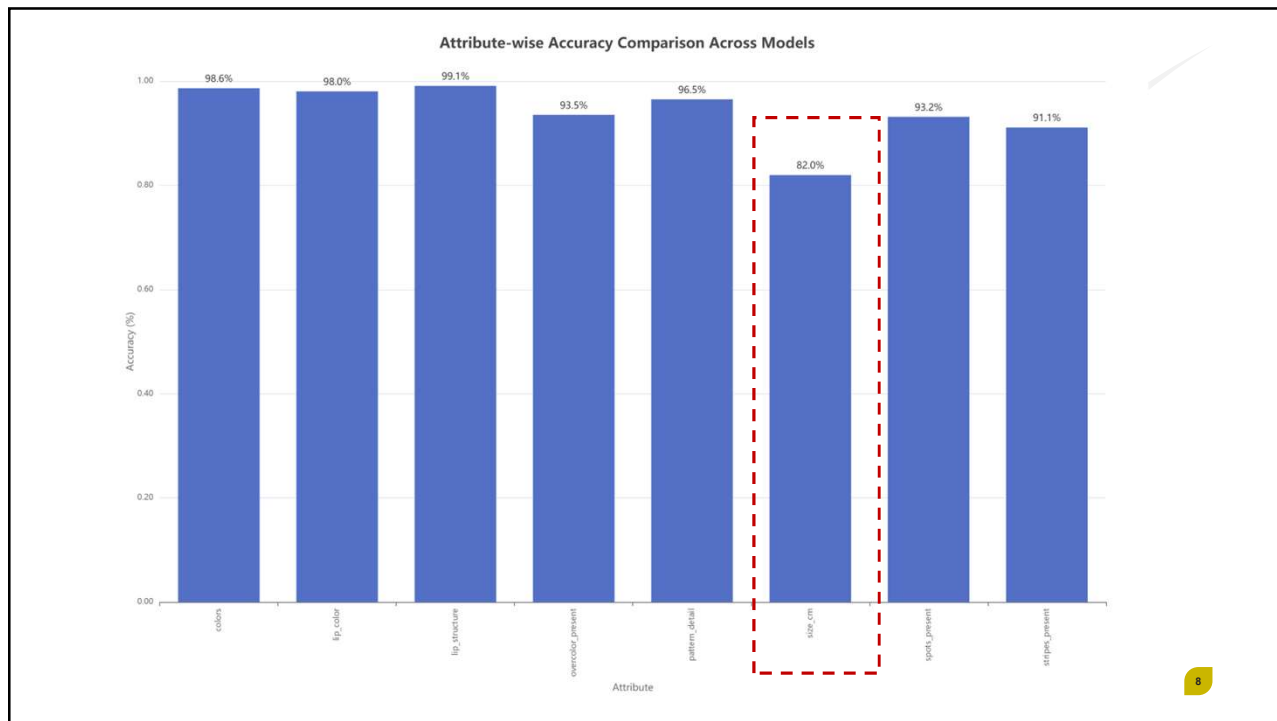
Is Hit/Validated

Search:

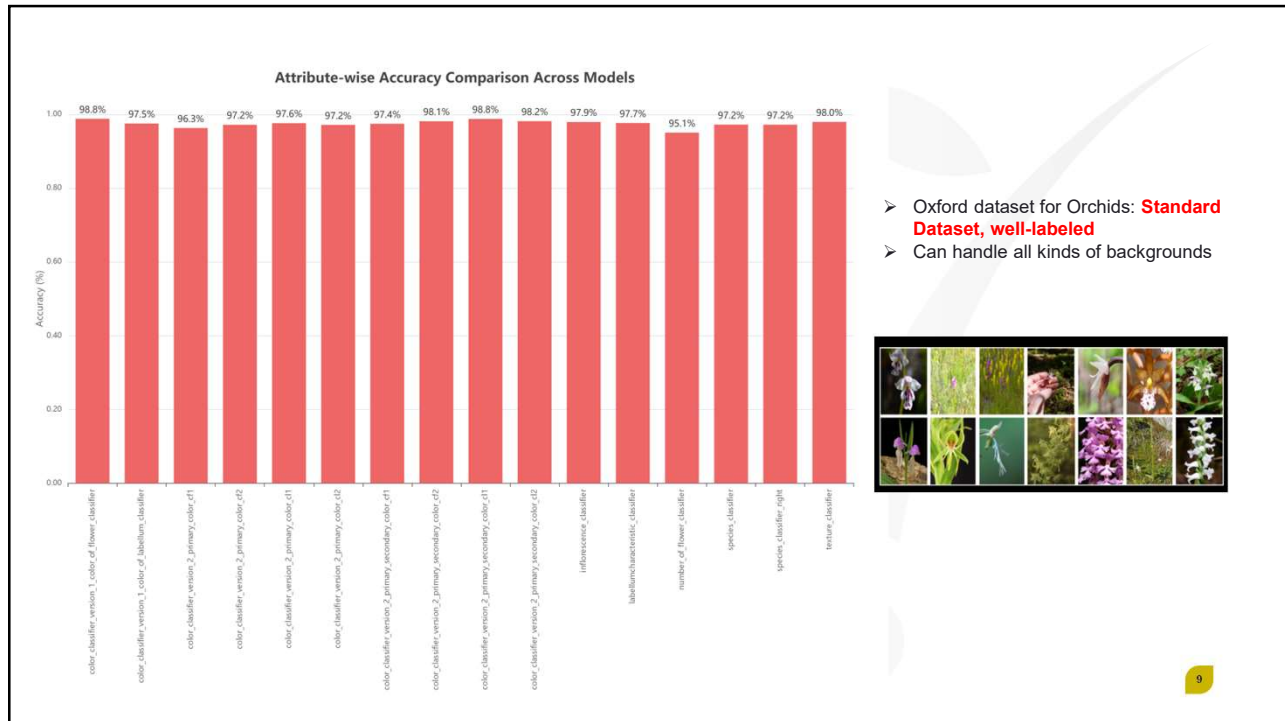
Name	Hit attribute	HP	QP	C...
lip_structure	biglip	100.00%	100.00%	✓
pattern_detail	NA	100.00%	100.00%	✓
Petal_breedite_deel	basis	100.00%	100.00%	✓
petalen_rakend	vrij	100.00%	100.00%	✓
Lepaal_spots_afwez...	kaarwez	100.00%	100.00%	✓
Zijlob_netting_afwez...	NA	100.00%	100.00%	✓
Dispaal_netting_afw...	kaarwez	100.00%	100.00%	✓
Zijlob_strepen_afwez...	NA	100.00%	100.00%	✓
Eindlob_netting_afw...	kaarwez	0.05%	100.00%	✗
Snor	kaarwez	100.00%	100.00%	✓

Previous 1 2 3 4 5 6 8 Next

7




8









9

Trial 2025



Query

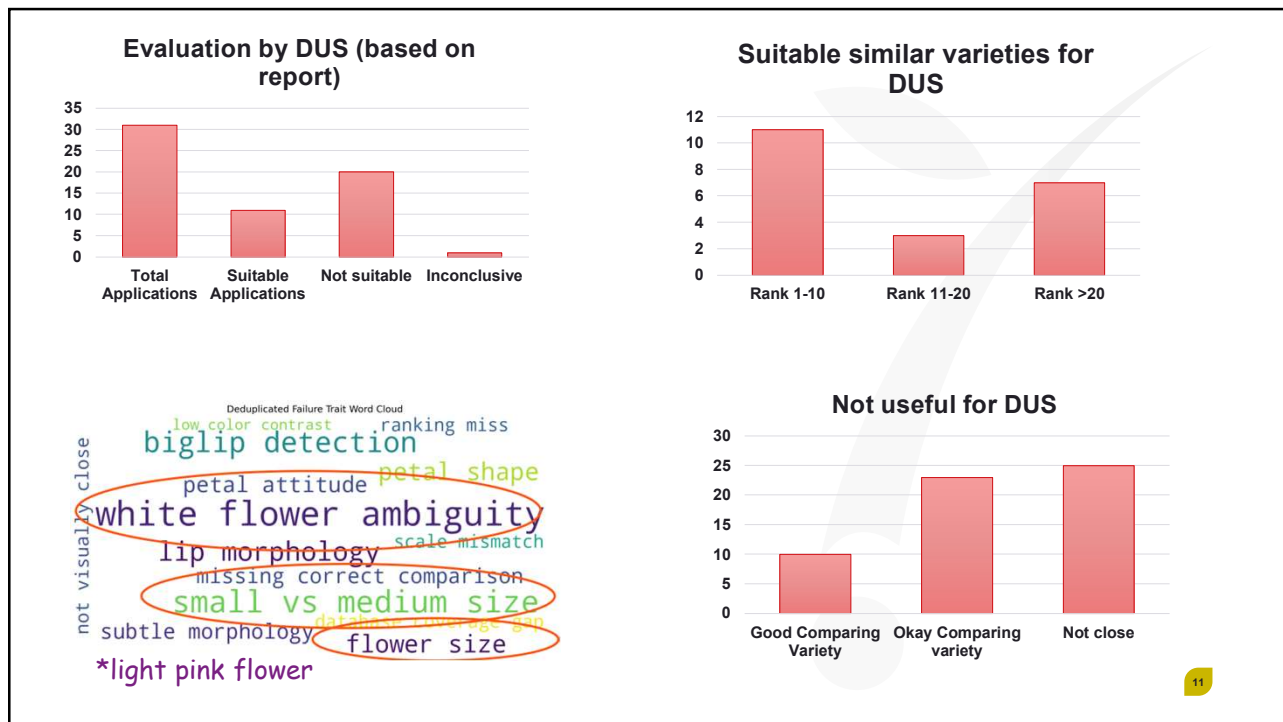
Manual selection (DUS)	AI selection	AI Rank
		15
		10

AI Alternative comparators	Manual Check	AI Rank
	Suitable/not suitable	Top 3
	Suitable/not suitable	Top 3

!!Assumptions

- Similarity check (and not Identity check)
- Only top 3 hits of the AI-predicted comparators were checked (very strict)
- Can assign preferential weights to grouping characteristics, analysis is pending (high season time!!)
- Current trial ongoing...

10



11

About Data & Models...


Data

- Data acquisition needs more efforts
- Consistent calibration references are essential
- Meta Data for size needs attention
 - Relative size is not an easy measurement
- More focused analysis on flowers with low contrast (also a struggle for humans)
- Error analysis indicates that the conversion of metadata annotations (UPOV Scale) -> Binary scale can lead to loss of information

Model


- The AI model shows **promising retrieval capability**
- When it is useful, relevant similar varieties are frequently retrieved in the **Top 10**
- The model could handle inconsistent backgrounds
- Multiple models tried -> similar patterns
- Good at coarse similarity
- Weak at fine-grained discrimination
- Current performance is **not sufficiently reliable** for autonomous DUS similar variety selection -> Can be an accompanying search tool in near future

Difficult candidate (2019)



- White color, violet over colour
- Petals with stripes, netting but also spots near the center
- Lip with multiple colours and complex patterns
- Lip with spots on the apical lobe which are hard to see because of the attitude of the lip
- Lip with stripes and netting on the lateral lobe
- Hard to judge the shape of Dorsal sepal and Lateral sepals because they are "behind" the petals on the photo

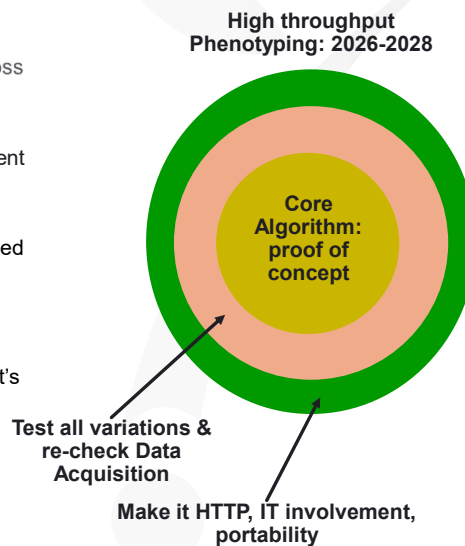
Reported Similar Variety (#20)



12

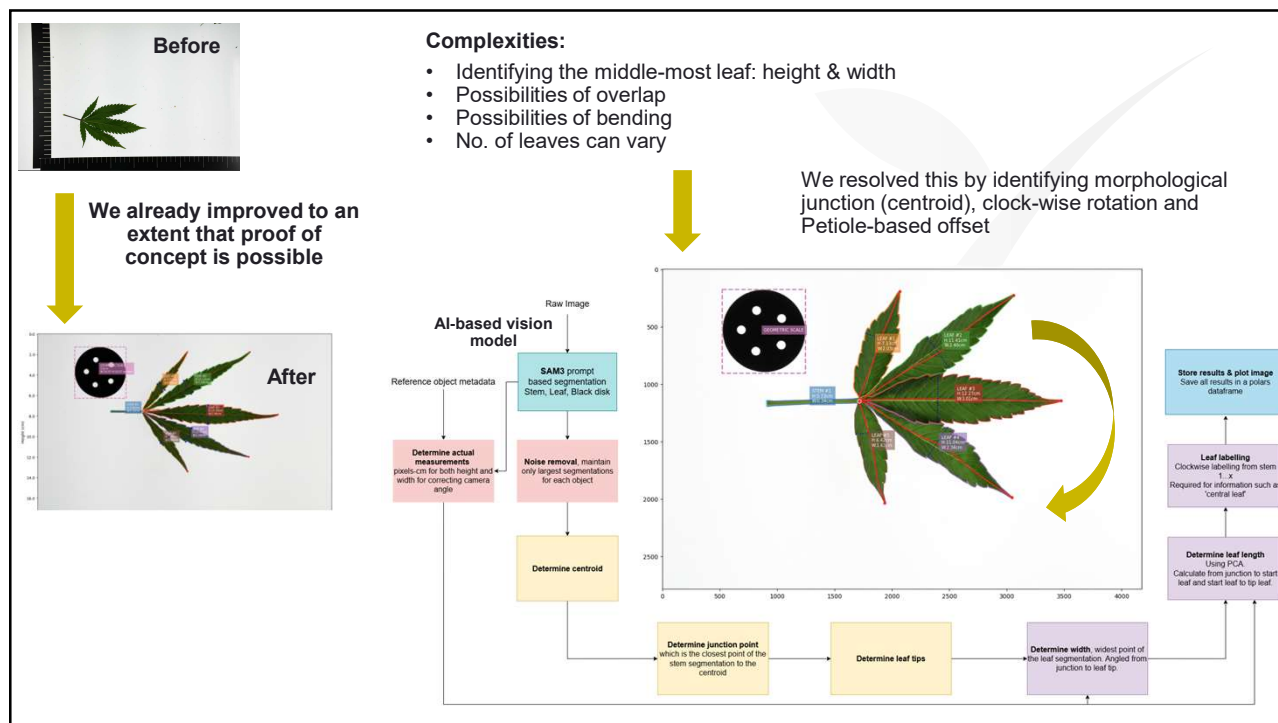
Image Analysis @Naktuinbouw

- Naktuinbouw has been using image analysis for several years across a variety of crops
- Now we are in a position to bring all programs/data under one-umbrella-try to have a single pipeline, but multiple options for different organs organized in a database
- We started with Cannabis since images are already there. The leaf characteristics are important for variety identification and can be used for grouping the varieties based on similarity and organize the trial
- We are also doing the Strawberry leaf side by side and providing feedback for good image acquisition
 - We expect to do a huge amount of leaf observations and thus it's a good candidate for HTP

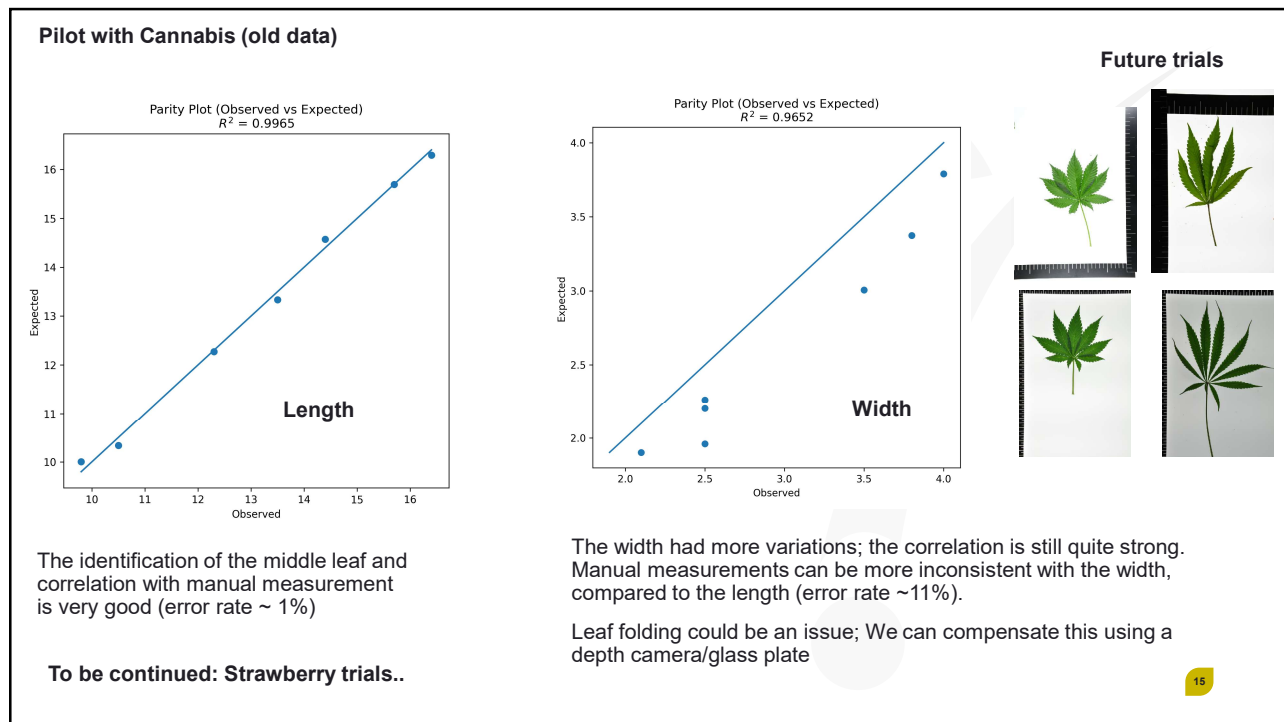


13

13



14



15

Conclusion

- **Image Analysis (& AI under the hood)** shows promising results for quantitative characteristics
 - We will continue in this direction
 - **Data management** is important for efficiency (organize data outputs into Phenotype Database with images, trial information and other tools for comparisons.)
- **For ornamentals**, there are some open questions:
 - We will need to think (or re-think ?) how we see our **variety collections** (common knowledge) ?
 - Is it even possible to make a good training dataset out of variety collections ?
 - Some characteristics are more complicated than others to automate..if they are the main grouping characteristics, it will be an issue..
 - We must adapt our current way of working (making pictures) in order to obtain data that are useful for Image analysis with help of AI
- **For Discussion (Open questions)**
 - In future, can we have other kinds of characteristics based on AI/CV ?
 - Possibilities of including AI & manually predicted characteristics to come to conclusions ?
 - Would it be possible to make standards that are useful in different environments?
 - Having Image standards to share across EOs ?

16



It's a Team Work! 

Jesper Guijt
(Bioinformatics)


Koen van Oostrom
(DUS Examiner)

Judith Meijles
(DUS Examiner)

Michel Ebskamp
(Manager R&D)

Raoul Heagens
(Head Identity & Variety Research)

Raad voor 
plantenrassen

nak  **tuinbouw**

Thank you for your attention !

S.Sircar@naktuinbouw.nl

