Journée PHENOME-EMPHASIS

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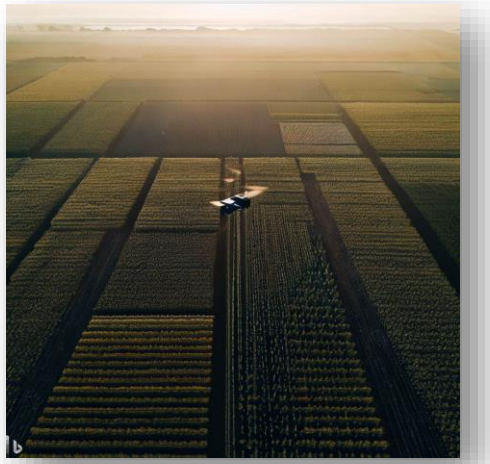
Why to use innovative phenotyping techniques in plant breeding / hybrid evaluation?

Time savings



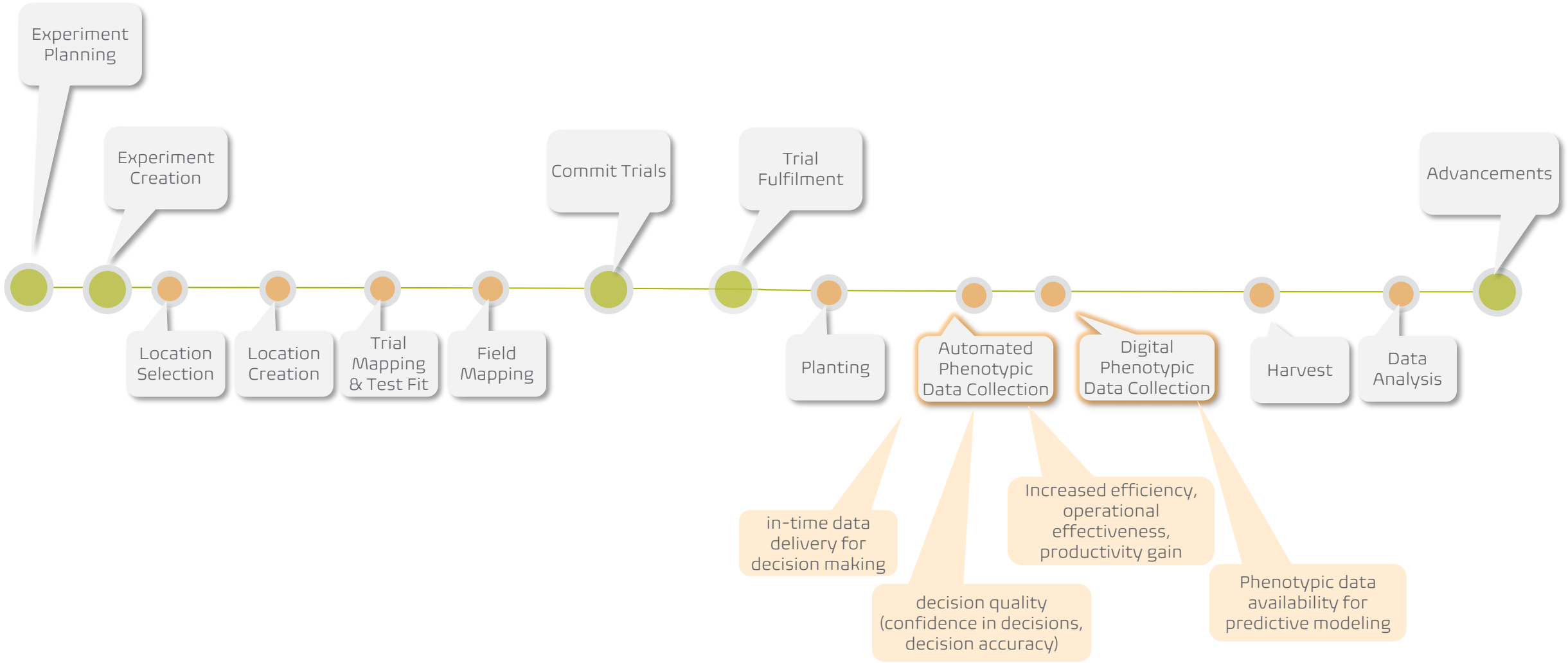
Non-destructive

High spatial and temporal resolution

Improve hybrid selection

Cost reduction

Where to do the transformation ?



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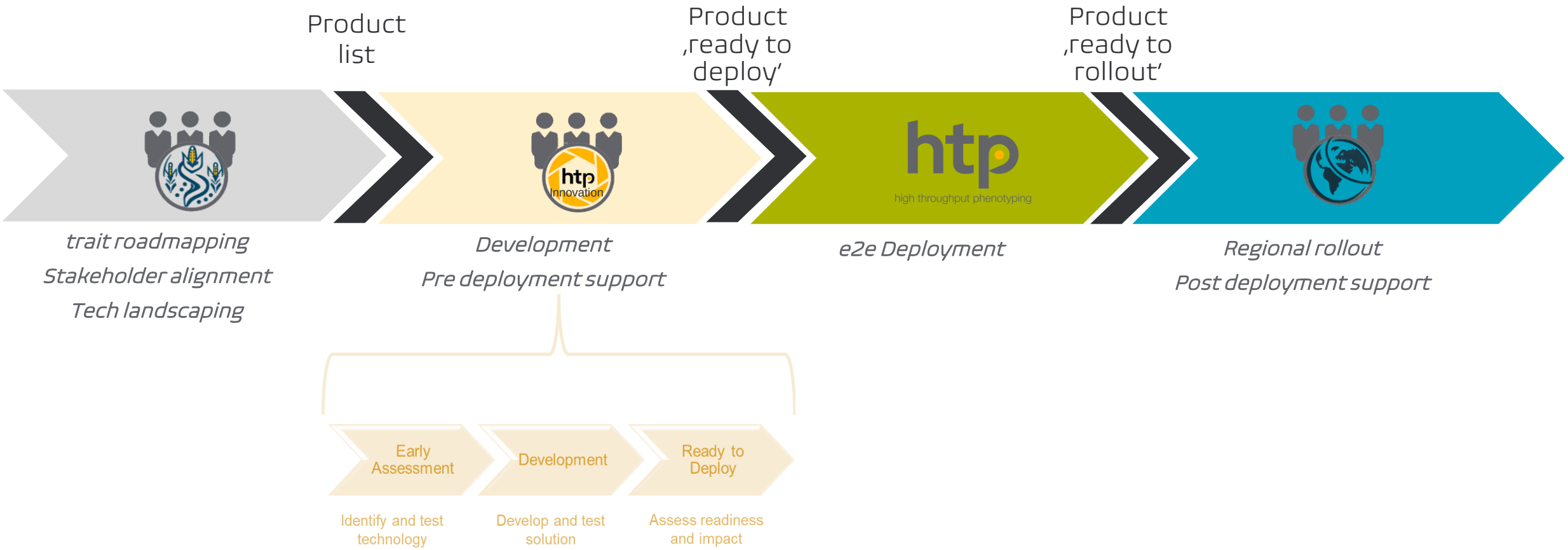
How to create a technical solution ?

Phenomics product development cycle



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What can be done ?

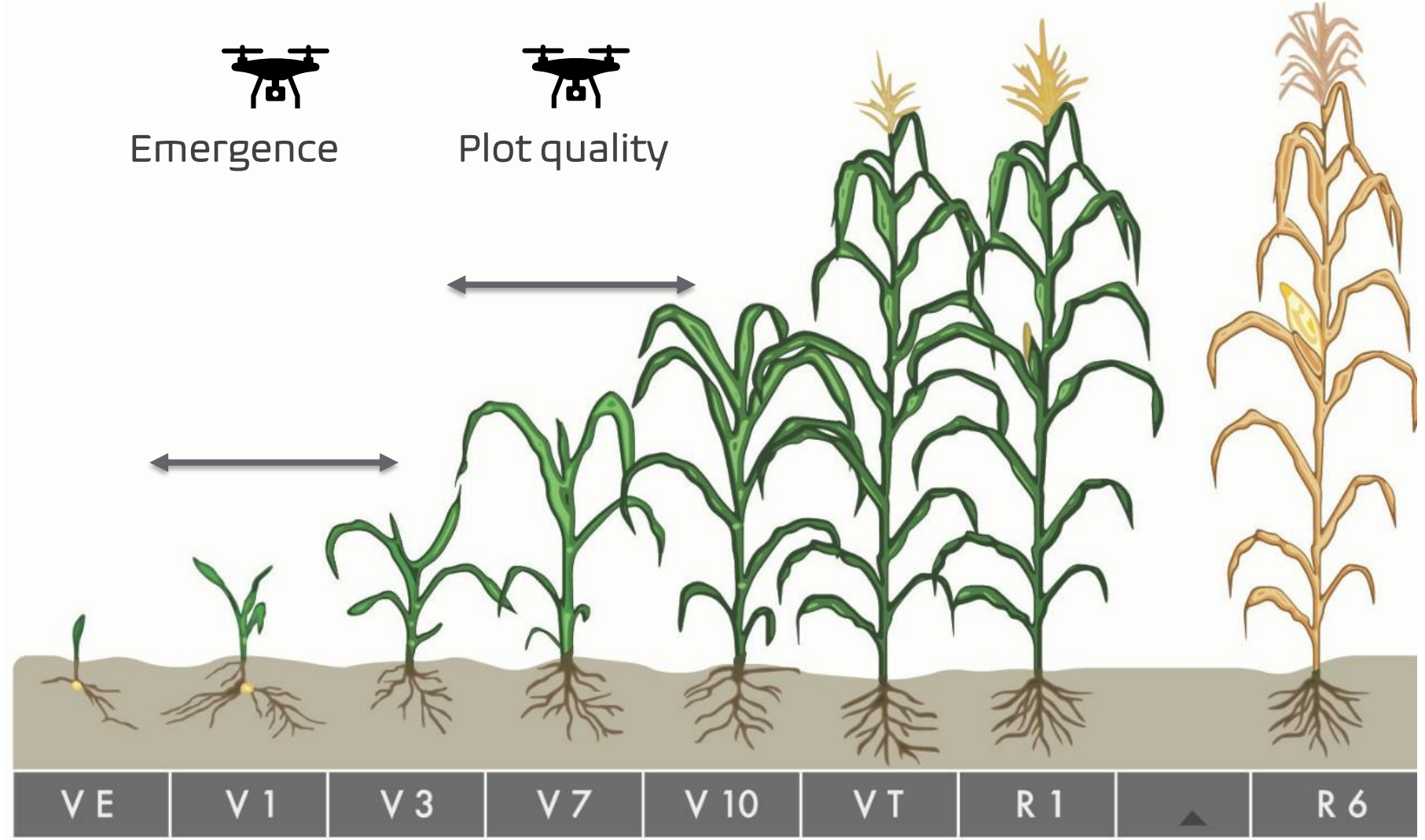
Plant-related traits

Plant height
Flowering time
Rolling
(...)

Operational-related traits

Plot quality
Plot length
Product application
(...)

What can be done ?



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What can be done ?

Corn

Trial Type
Performance

TRAIT CODE
EMRGN

REGION
Global

TRAIT TYPE
Performance

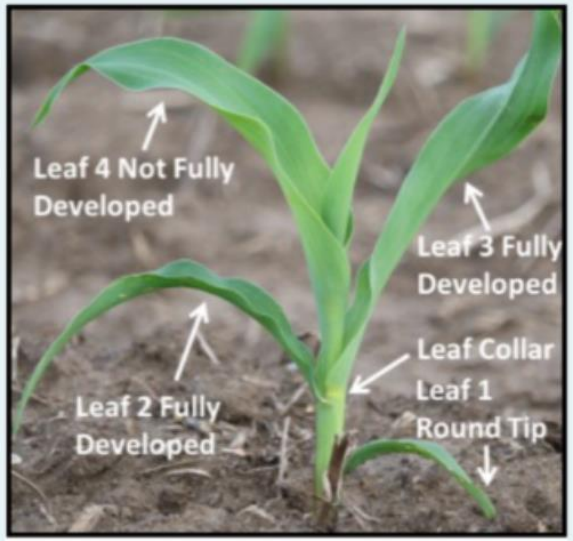
Emergence Count

MIN VALUE	MAX VALUE	VALID ENTRIES	UNIT OF MEASURE
0	TBC		N/A

WHEN TO COLLECT
Between BBCH 10-13 / V1-V3 leaf stages

HOW TO COLLECT
Number or percent of plants that emerged prior to thinning measured by counting the number plants within the data rows. Emergence percent.
Taken prior to thinning or anytime in which 100% of viable seeds have emerged.
2 row plot: Count total number of emerged plants only if >15% of the plot didn't emerge. Otherwise enter the average from a minimum of 10 plots with full stands in that field.
4 row plot: Count total number of emerged plants within data rows.
— If all 4 rows will be harvested count 4 rows
— If only 2 rows will be harvested for data only count 2
8 row plot: Count total number of emerged plants within data rows: middle 4 rows that will be harvested for data.

HOW TO MEASURE
Measure



V3 Plant

What can be done ?

Corn

Trial Type
Agronomic

TRAIT CODE
PLTQR

REGION
Global

TRAIT TYPE
Agronomic

Plot Quality Rating

MIN VALUE	MAX VALUE	VALID ENTRIES	UNIT OF MEASURE
1	9	1,5,9	N/A

WHEN TO COLLECT
Until BBCH 18/ before V9 leaf stage

HOW TO COLLECT
Plot Quality Rating is a visual rating to help with data editing. The rating signifies some type of damage to the plot that may affect yield at harvest based on the micro environment. Examples include weed pressure, soil saturation, mechanical damage, etc.

It is recommended to take the note preferably after thinning after cultivating and/or spraying. Taking the note too early may not capture nitrogen deficiency issues or some mid season water damage. Rating can be updated throughout the season as needed.

HOW TO MEASURE
Rating

1=No apparent plot damage affecting yield – No data editing needed
For ratings above 1 explain in PLTQT
5=Moderate plot damage affecting yield. Acceptable plant size with some non-uniformity in plant growth. May want to revisit plot in the fall.
9=Severe plot damage affecting yield. Small plants with poor uniformity. PLOT TO BE EXCLUDED FROM ANALYSIS.
Note: 2, 3, 4, 6, 7 and 8 are not used

What can be done ?

EAME H2022

$ Business case

150-200k$ per year efficiency gain. **Plus high quality data!**

VOLUMES

CORN: 235.000 plots
Across 8 countries

CROPS

Implementation of drone phenotyping **CORN** in EAME

TRAITS

Emergence and Plot quality for corn

Resources

30+ pilots in EAME **10 key-users**

Trait extraction

In-house ML development for PLTQR in Corn

HARDWARE

40+ drone packages across EAME

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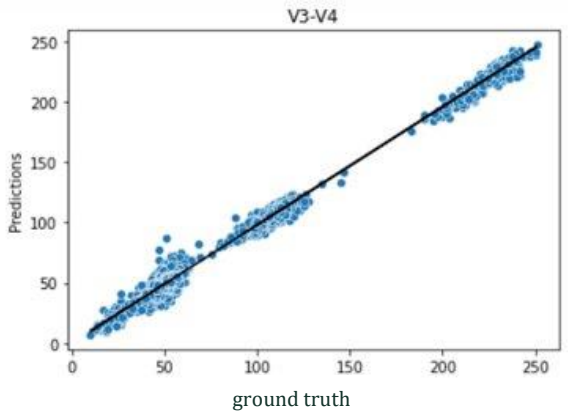
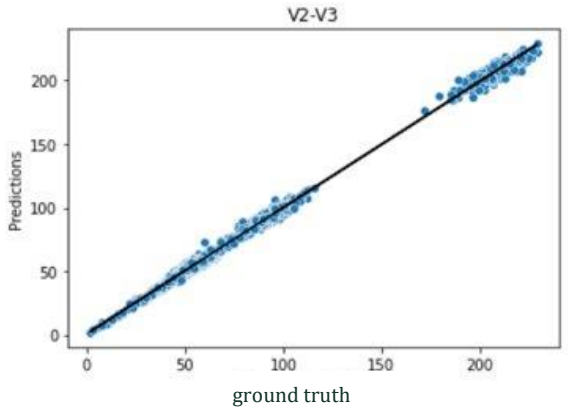
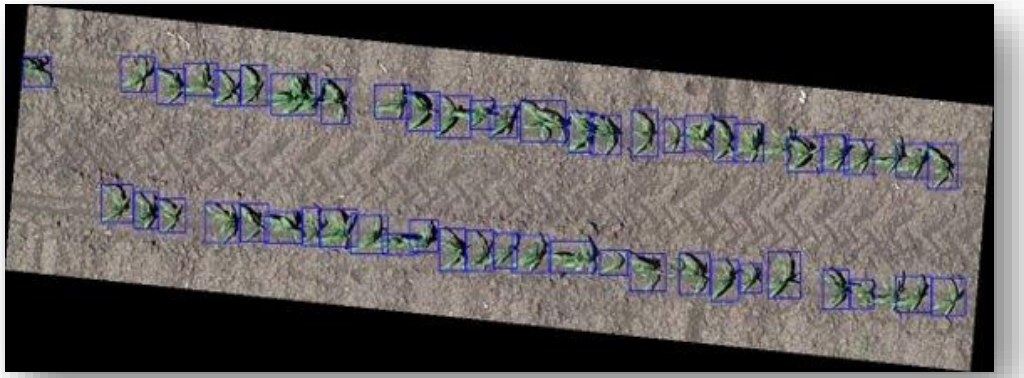
What can be done ?

Emergence





Correlation 0.93-.96



CONCLUSION

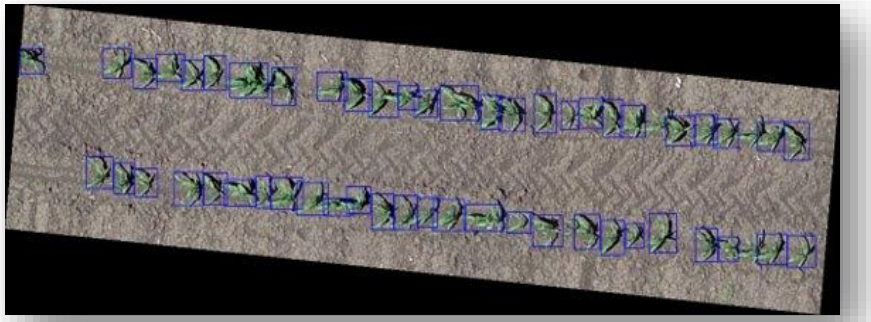
- Emergence is already a robust model!
- Accuracy can only be kept by repeating this activity in 2023 == Monitoring needed!

What can be done ?

Emergence

Results and conclusion

- Emergence is already a robust model!
- Resolution during processing improved/increased
- ML model also works on APAC locations without extra training
- Improvements to the ML model on challenging locations (e.g. HU locs 2022)
- Monitoring needed in 2023



What can be done ?

Plot quality

Rating, 1-9

1

No apparent plot damage affecting yield.

Overall good quality of the plot. Very good humogen, very little heterogeneity and/or missing plants observed.

5

Moderate plot damage affecting yield.

One of the harvested row is not uniform in leaf stage or/and part of the border row is missing, some gaps in central rows.

9

Severe plot damage affecting yield.

Bad quality of the plot. One or two rows heterogeneous, part of the central row is missing (more than 0.5m)

3

A bit more missing plant or heterogeneity vs. Rating 1.

7

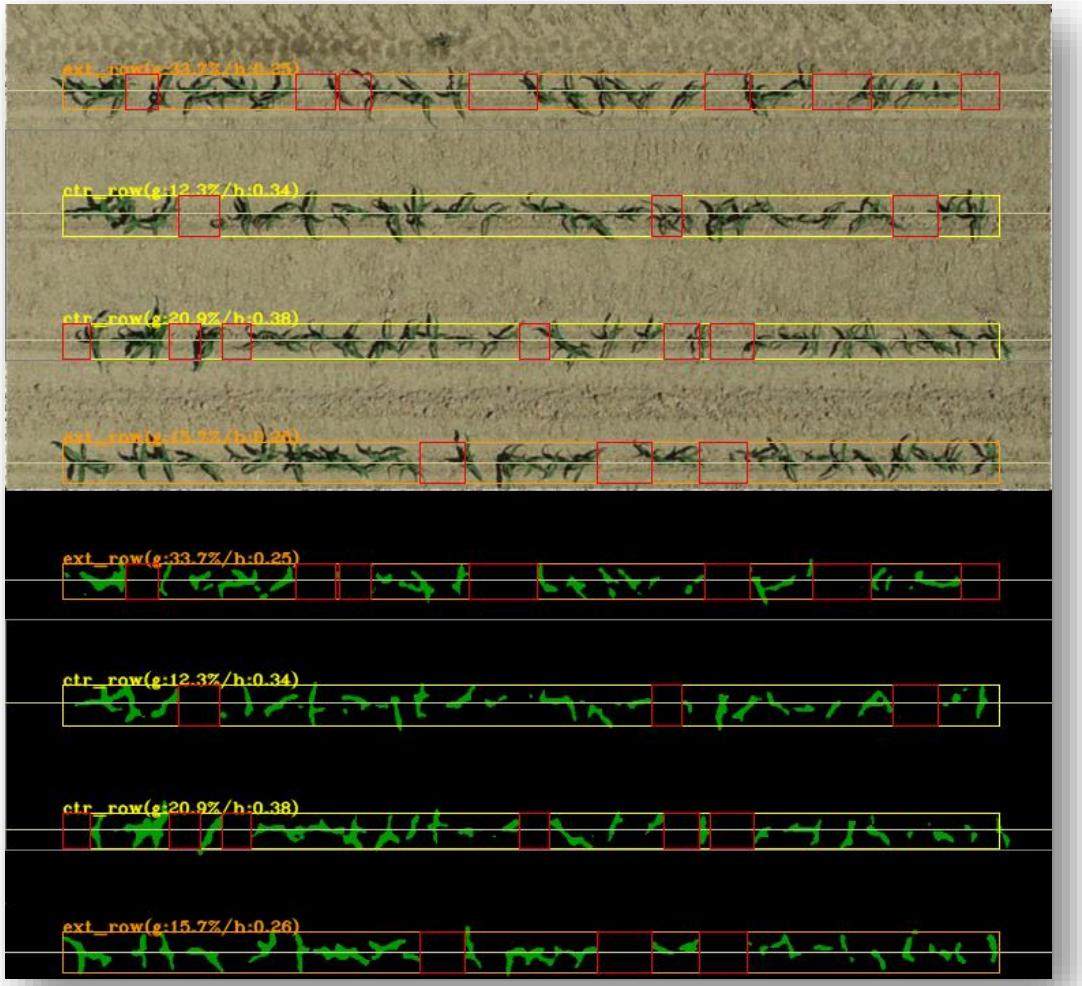
Border line quality, missing plant in central and border rows, plot shows heterogeneity.

What can be done ?

Plot quality

Results and conclusion

- Comparison of manual PLTQR data to UAV generated PLTQR
- 89% to 98% of agreement for discard or not-discard
- Some variations around the middle scores (3, 5 and 7)
- Around middle scores (3, 5 and 7) the algorithm is a bit more severe
- Can be adjusted >> Tunable algorithm!
- **BUT**, aim is too have only one algorithm for all countries/locations



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What can be done ?

Results and conclusion

Corn Location x

	Drone discard	Drone Keep
Manual Discard	45	15
Manual Keep	871	8450

Agreement: 91%

CONCLUSION

- The PLTQR by UAV is very well able to detect plots to be discarded (score 9) and perfect plots (score 1) for Corn
- More fine-tuning possible for middle scores, but “acceptable”

What next ?

- Extend to the whole corn trialing network
- Explore other traits (basic, complex)
- Extend to other crops
- Better integrate into the breeding schema to speed up selection and decision
- Look at all accessible technologies (satellites ?)
- Look at partnerships

Thanks

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