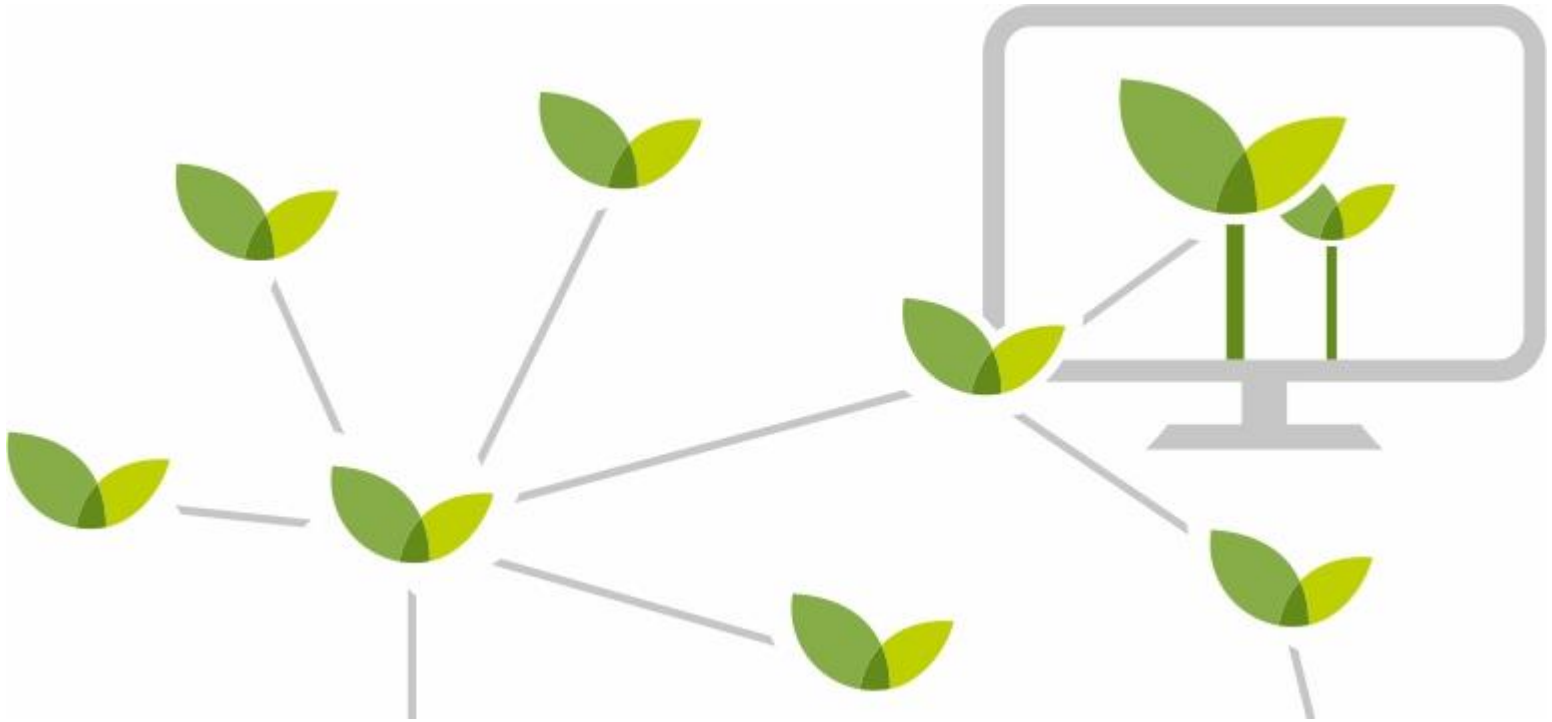

Smart phenotyping strategies for gene bank collections: a focus on crops with a long crop cycle and perennials

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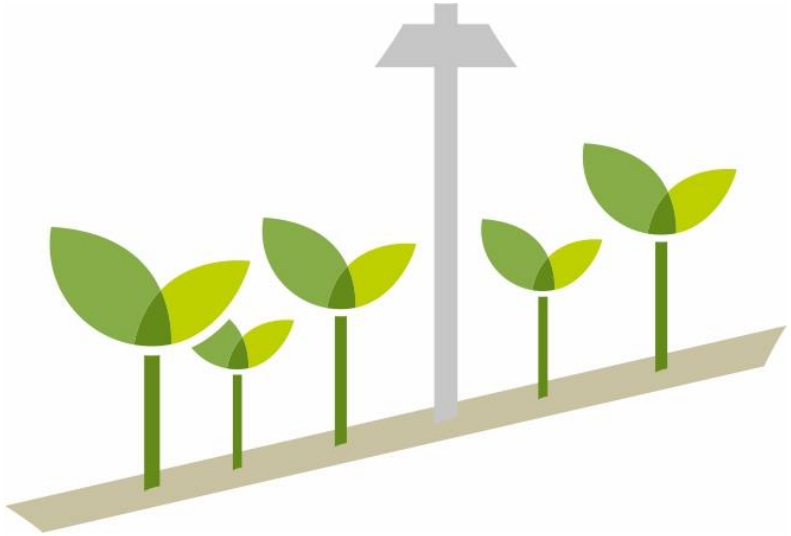
Challenges

- What traits are determining a breeding product?
  - Conditional effects of traits!
    - What to measure?
    - How to measure it?
- Long crop cycle ➔ huge influence of environment on the traits➔ spread of yield over time.

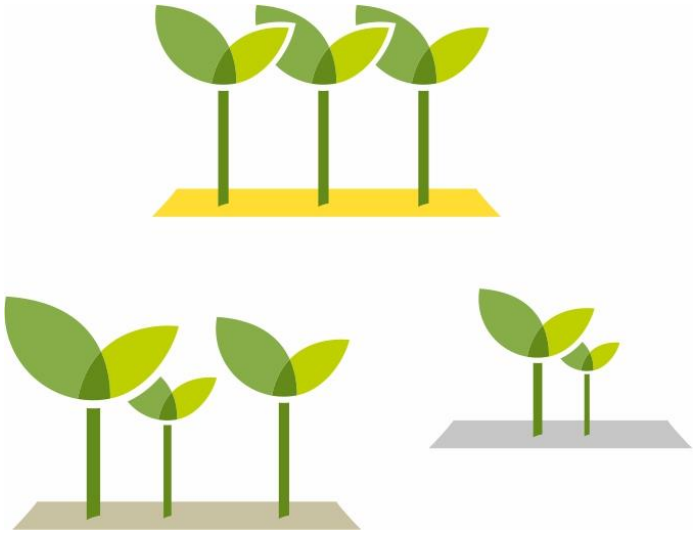
What to measure, how? ➔ Infrastructure

Controlled conditions

Research field station

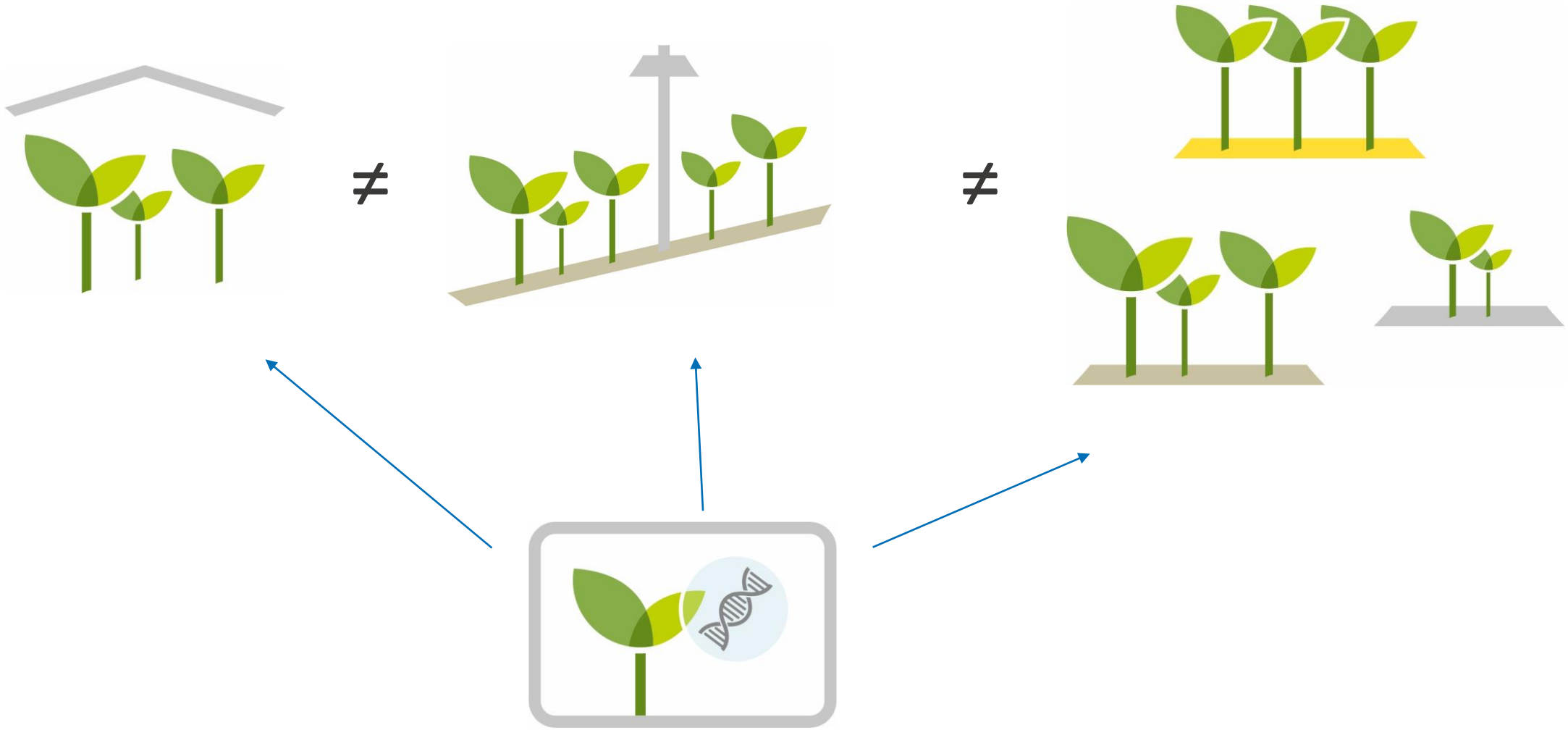


Citizen science in farmer's fields



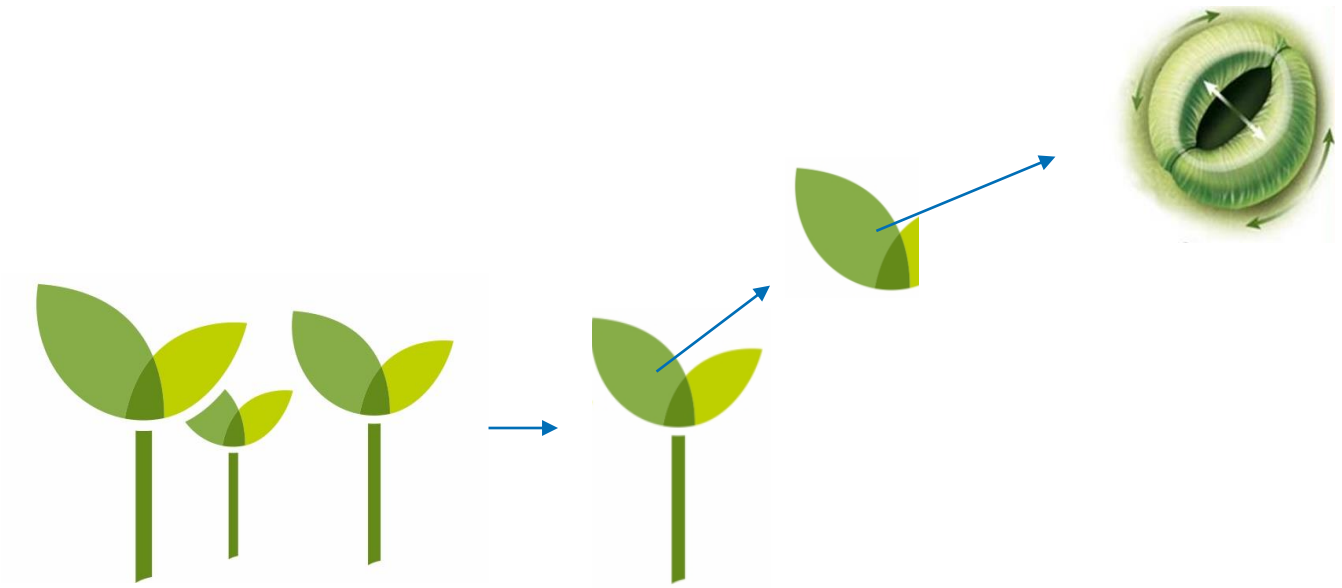
Images from: https://emphasis.plant-phenotyping.eu

To what extent are detailed traits related to yield?



Images from: https://emphasis.plant-phenotyping.eu

Challenge of scale of measurement



Canopy/field	Plant	Organ	Cell
M^2	cM^2 ~	cM^2 ~	μM^2 ~
months/years	days/weeks	minutes	minutes

Images from: https://emphasis.plant-phenotyping.eu

Modeling fluctuating environments and future local climates

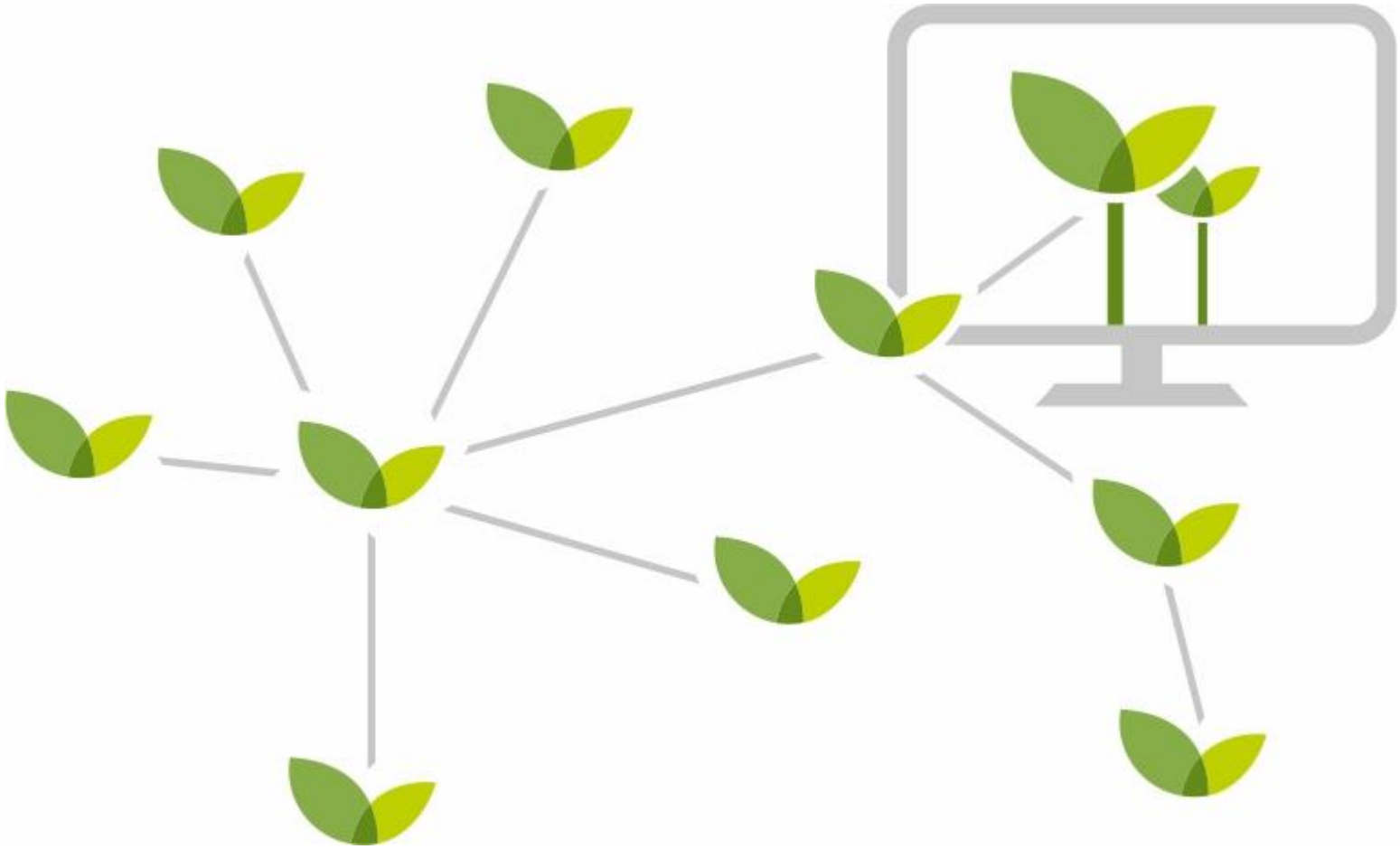


Image from: https://emphasis.plant-phenotyping.eu

Join forces across centers, countries and regions

Slide from Uli Schurr https://emphasis.plant-phenotyping.eu

Strategy

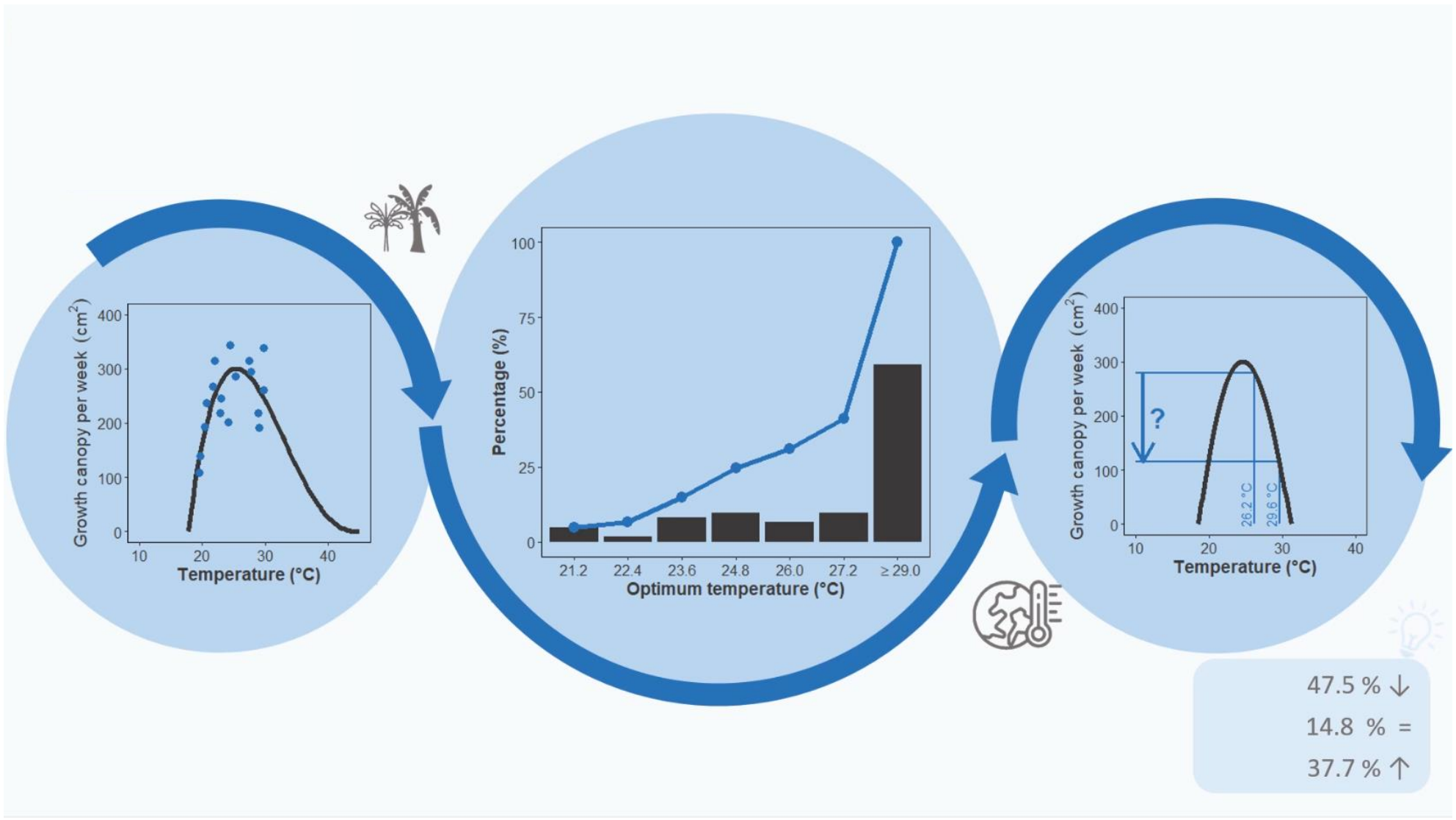
Genetic characterization

Controlled environment

Green house

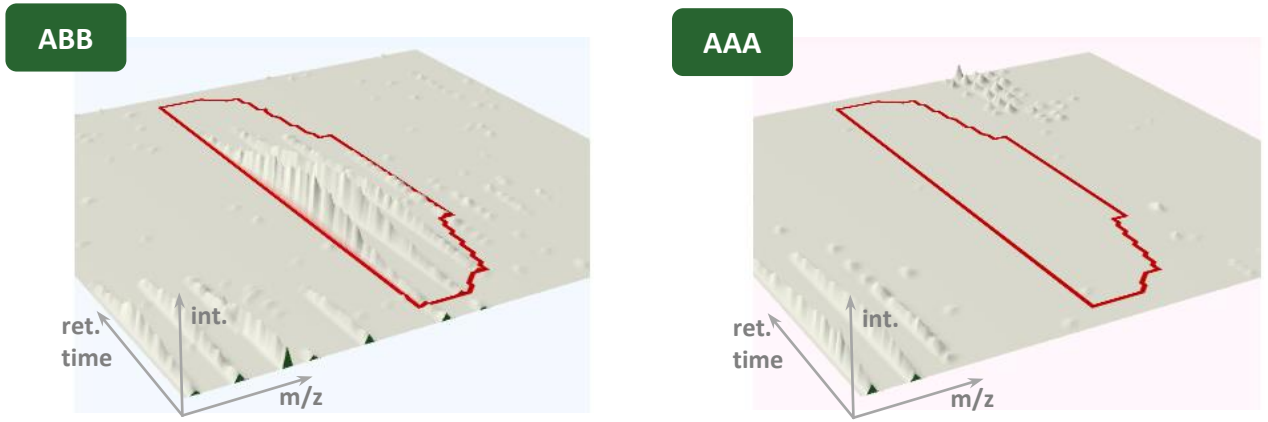
Field

Market & climate research / Seed systems / (pre)Breeding


Growth canopy per week (cm²)
400
300
200
100
0
10
20
30
40
Temperature (°C)
Percentage (%)
100
75
50
25
0
21.2
22.4
23.6
24.8
26.0
27.2
≥ 29.0
Optimum temperature (°C)
Growth canopy per week (cm²)
400
300
200
100
0
?
26.2 °C
29.6 °C
10
20
30
40
Temperature (°C)
47.5 % ↓
14.8 % =
37.7 % ↑

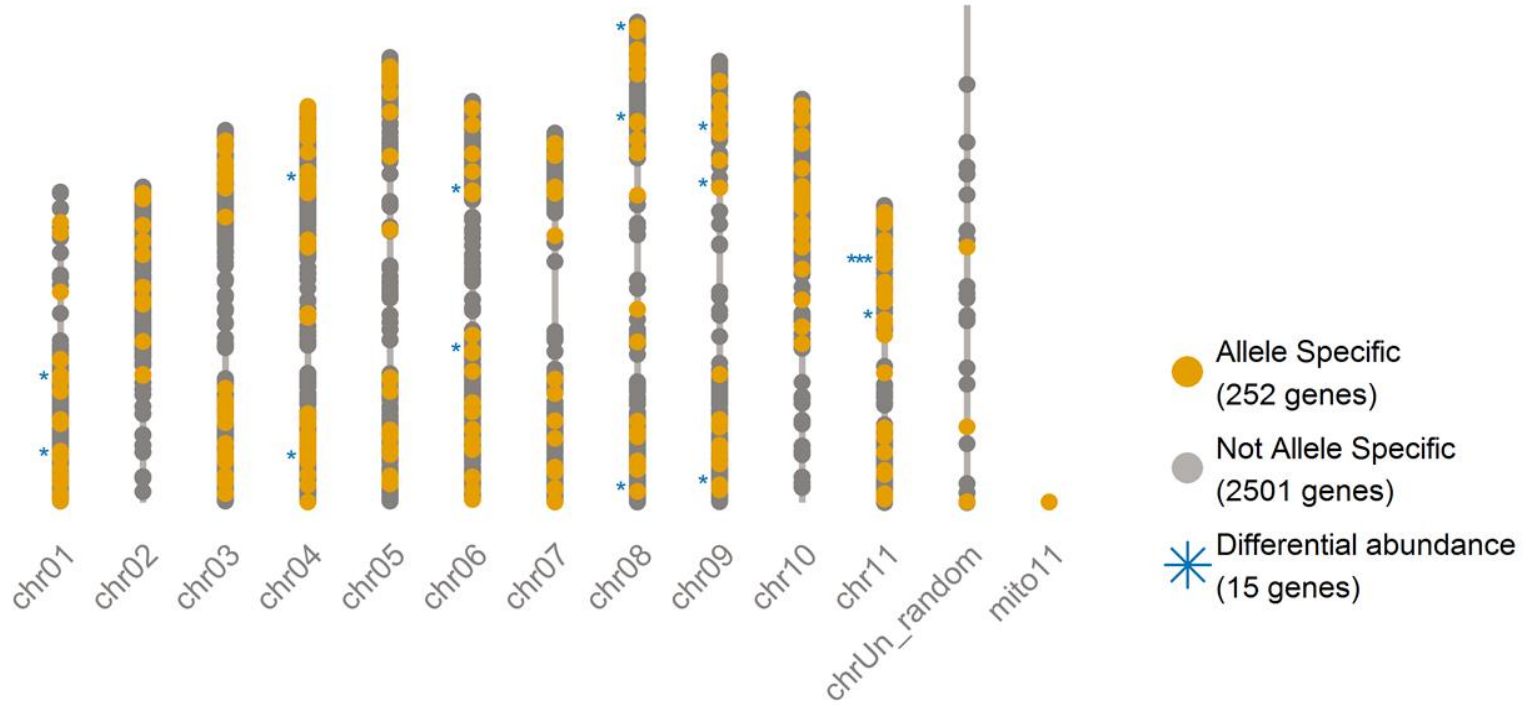
Integration of phenotyping and omics

Allele specific proteins



Carpentier 2020

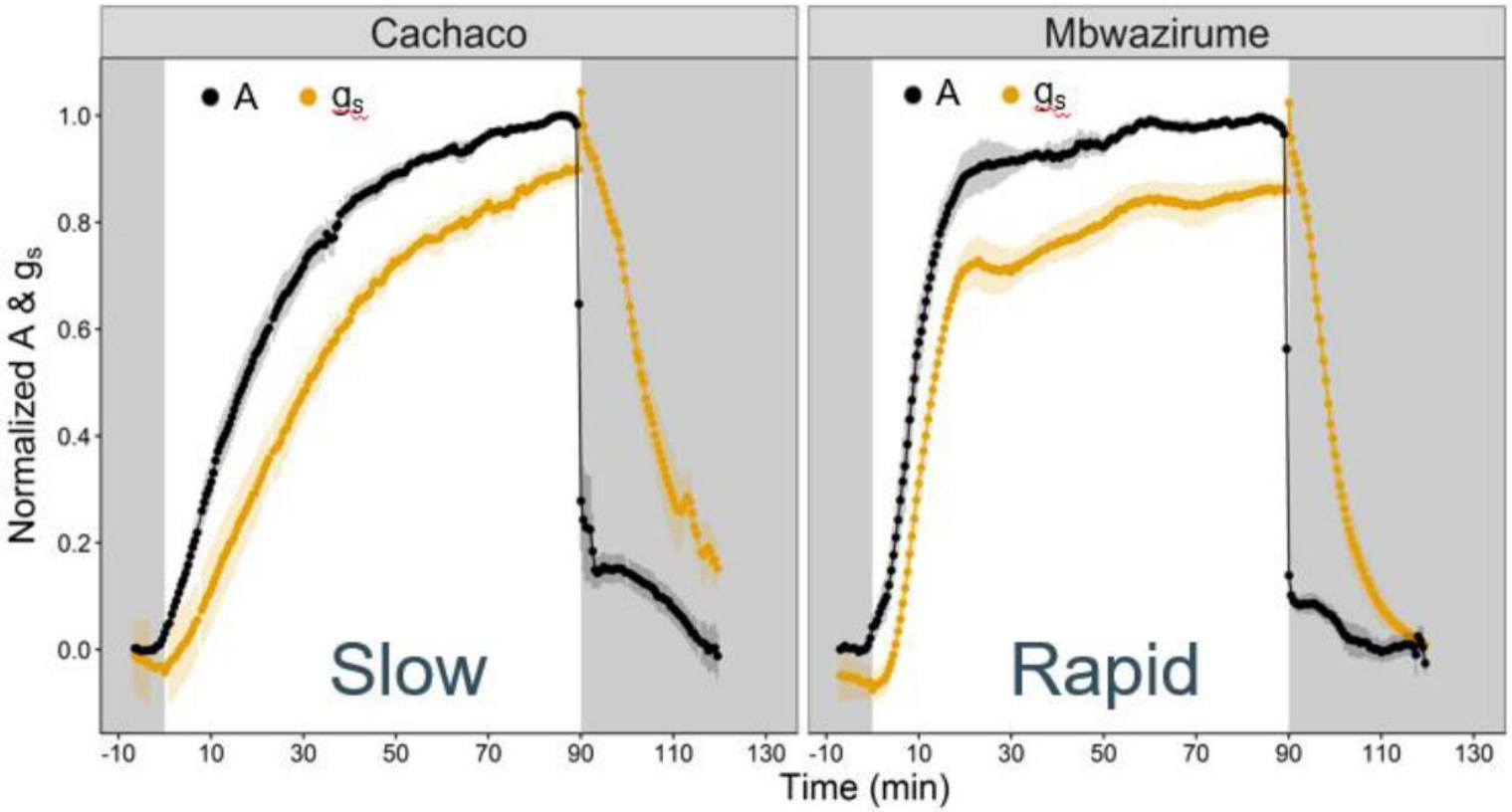
van Wesemael et al 2018 Campos et al.2018 Carpentier et al. 2011



van Wesemael et al 2018

Cenci et al. 2020

General plant growth and behaviour

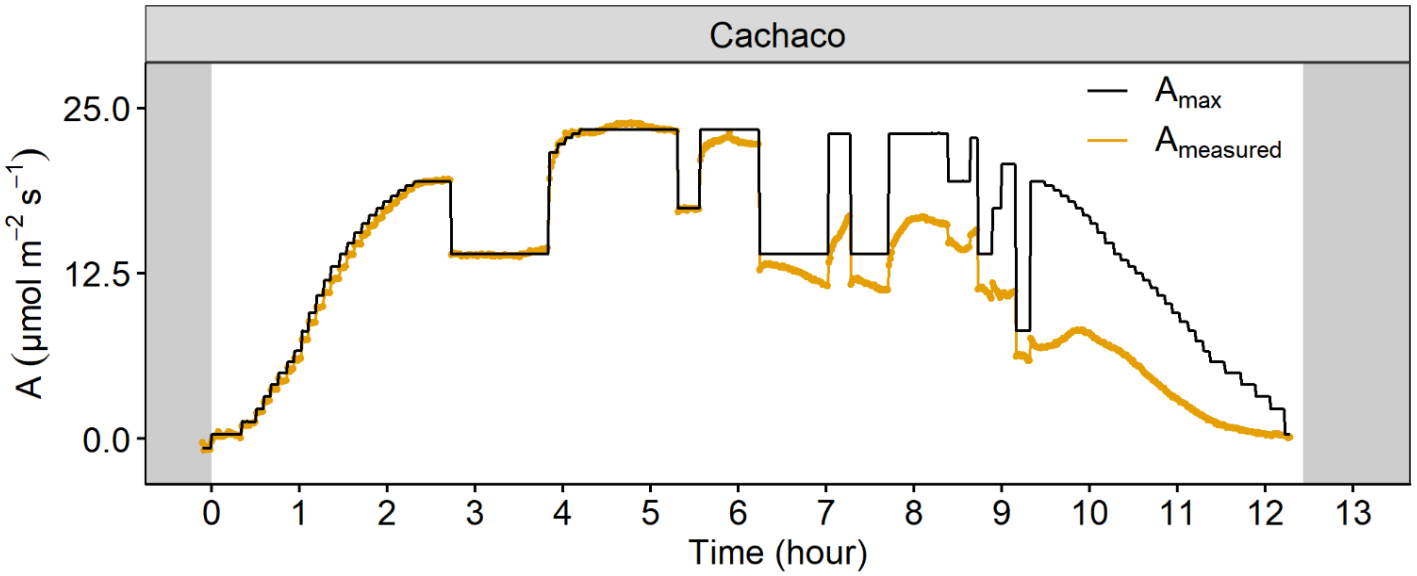


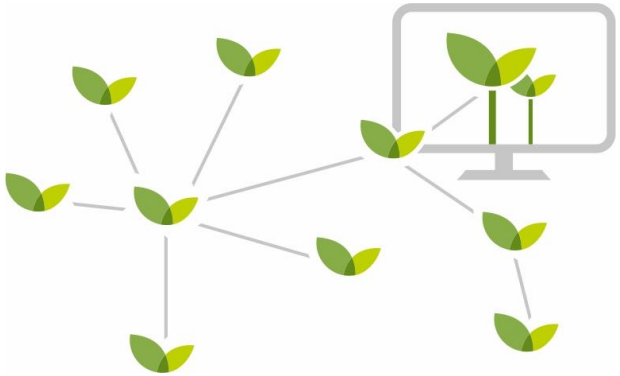
ABB

AAA

Eyland et al 2021

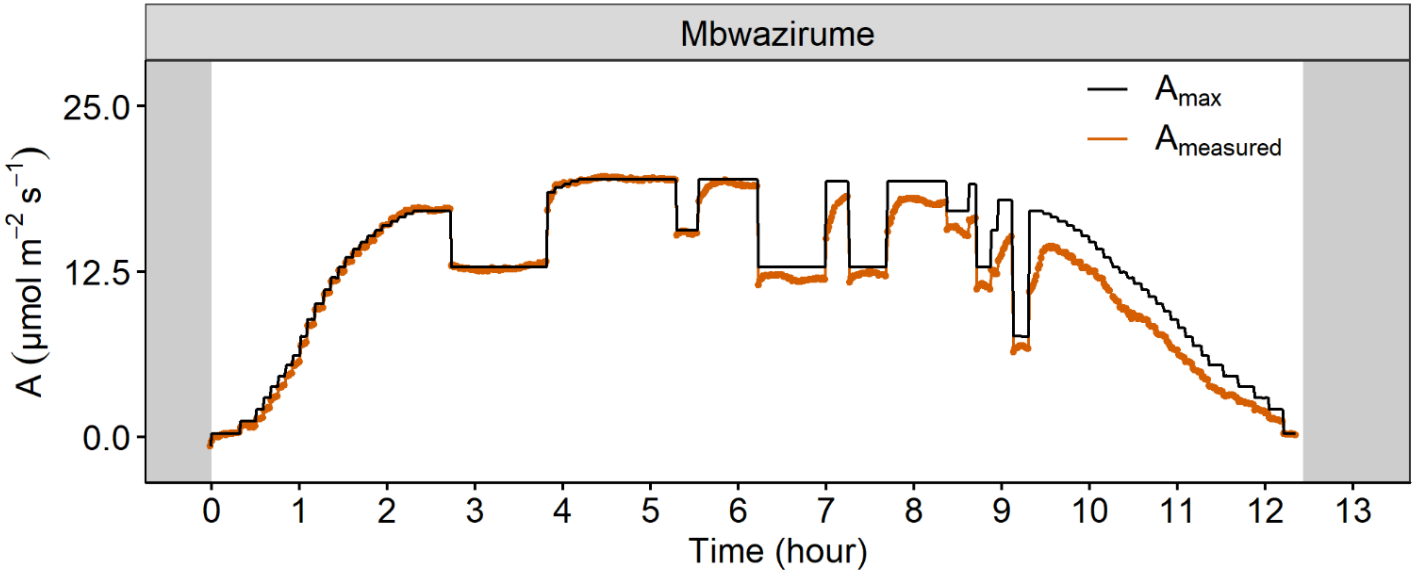
ABB





→ Conservative

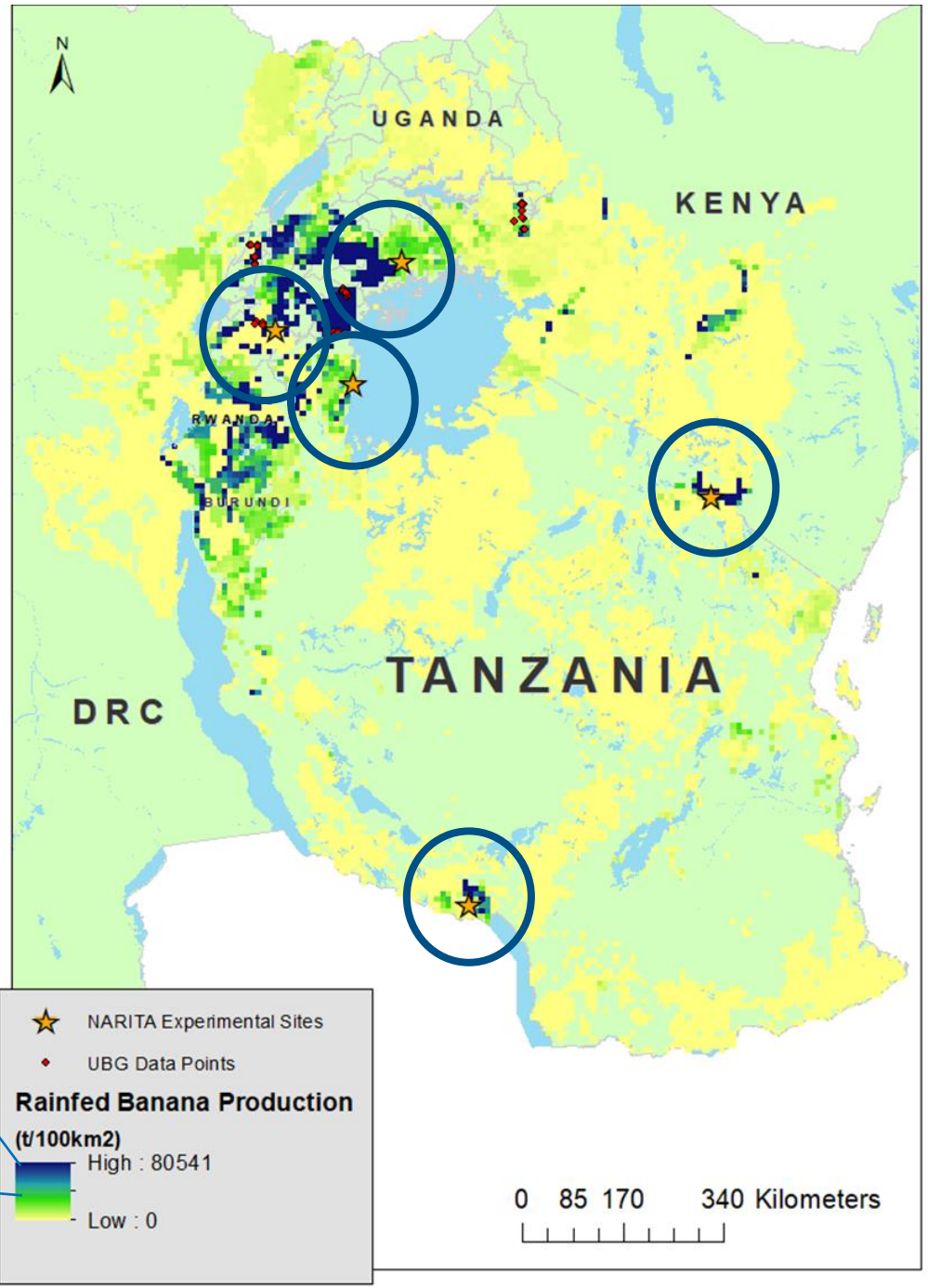
AAA



→ Risk taking

Eyland et al 2021 Plant physiology

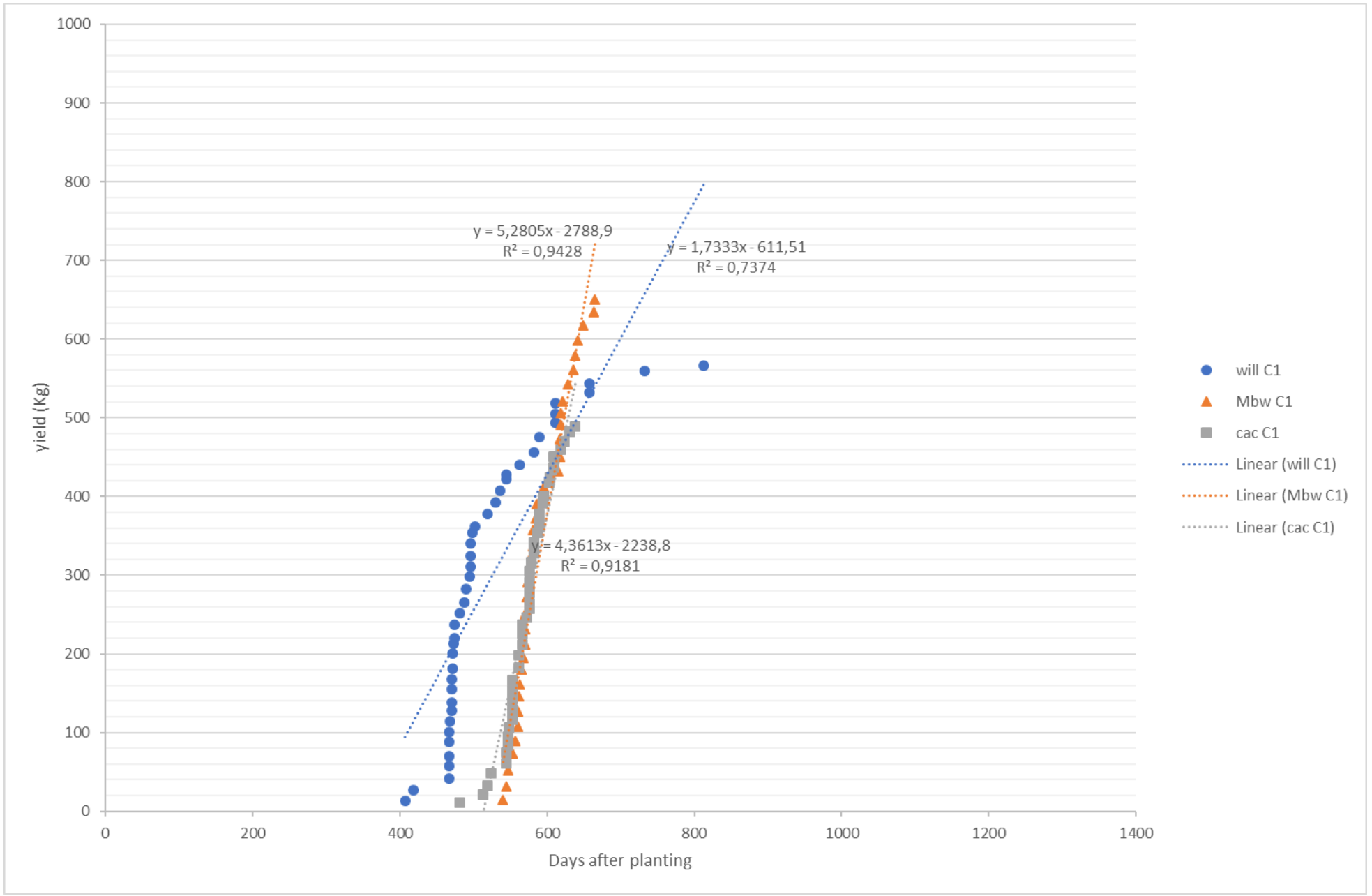
https://kavive.shinyapps.io/rtbclimateportal/

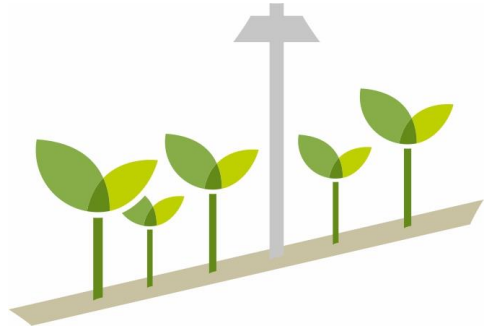


Risk taking wins

Conservative one taking wins

Lewis Machida **Noel Madalla**





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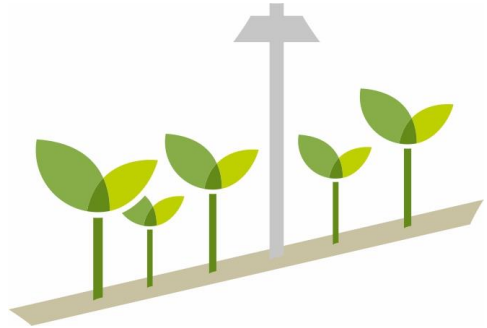
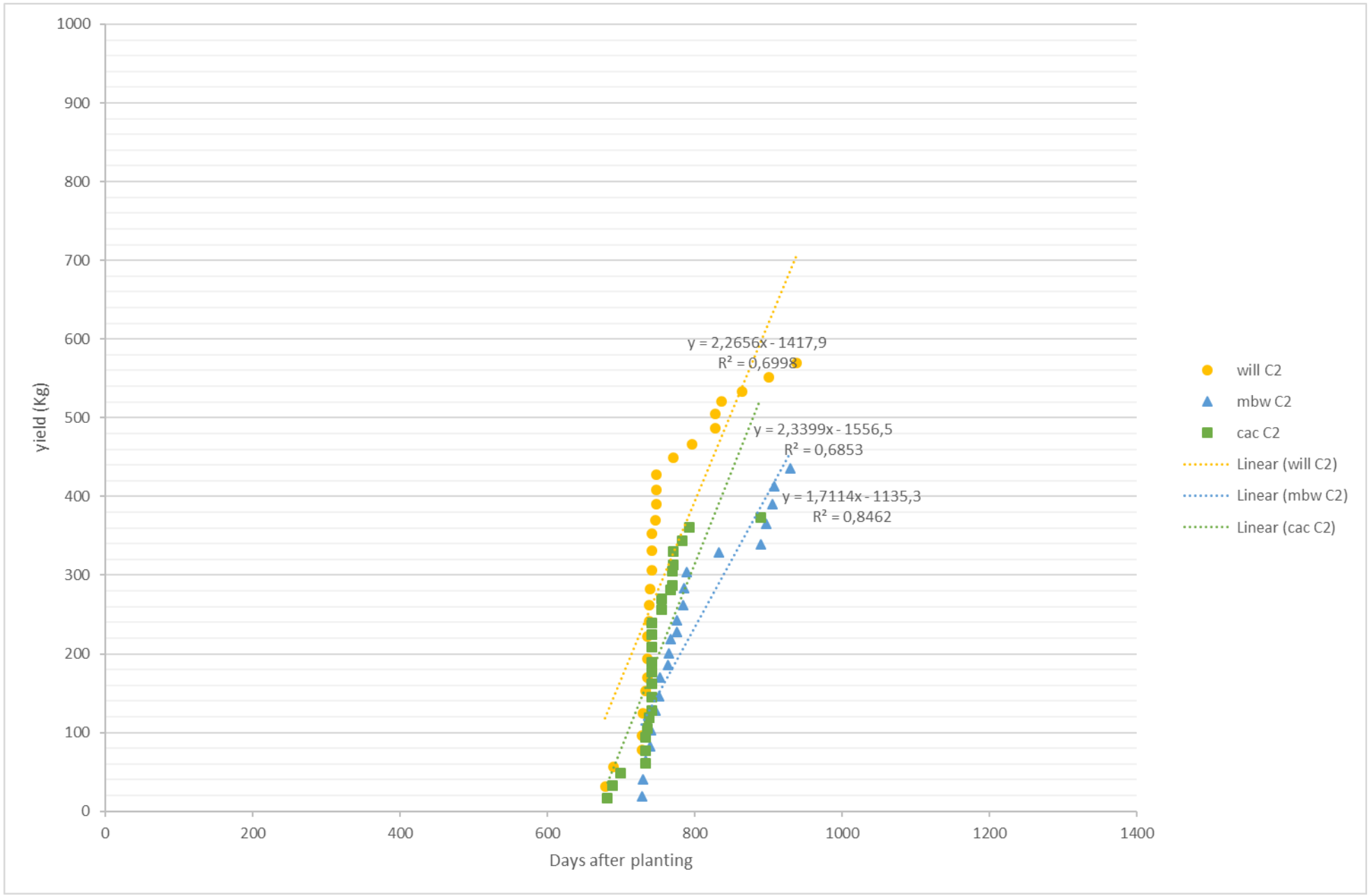
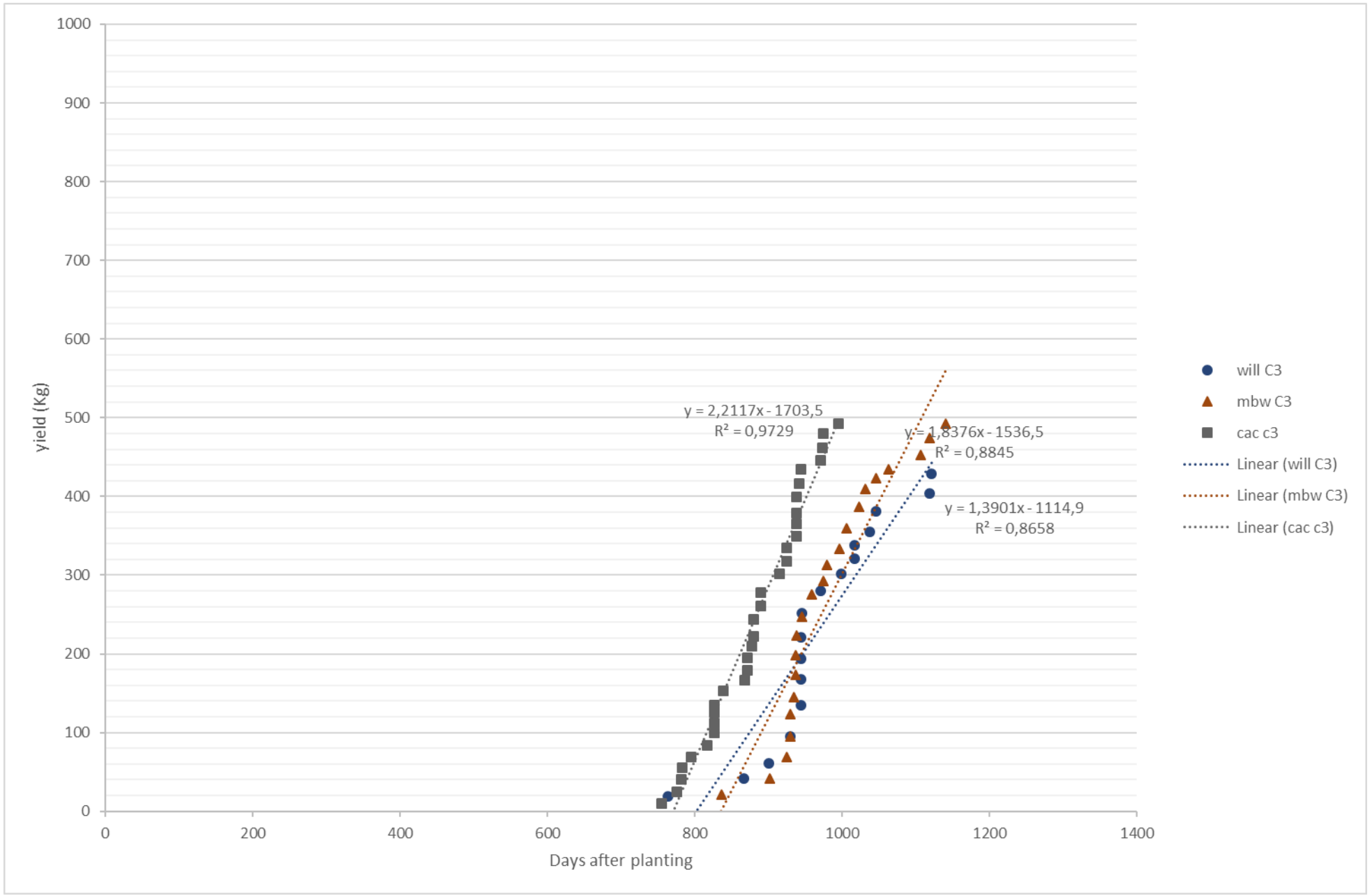
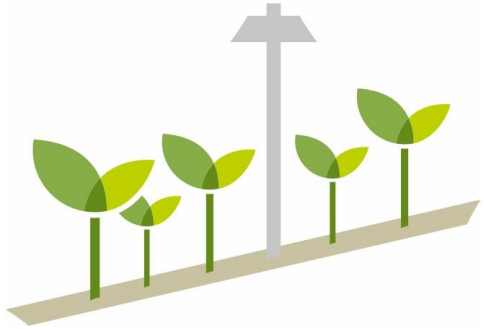



yield (Kg)
Days after planting
y = 2,2656x - 1417,9
R² = 0,6998
y = 2,3399x - 1556,5
R² = 0,6853
y = 1,7114x - 1135,3
R² = 0,8462
will C2
mbw C2
cac C2
Linear (will C2)
Linear (mbw C2)
Linear (cac C2)

Alliance





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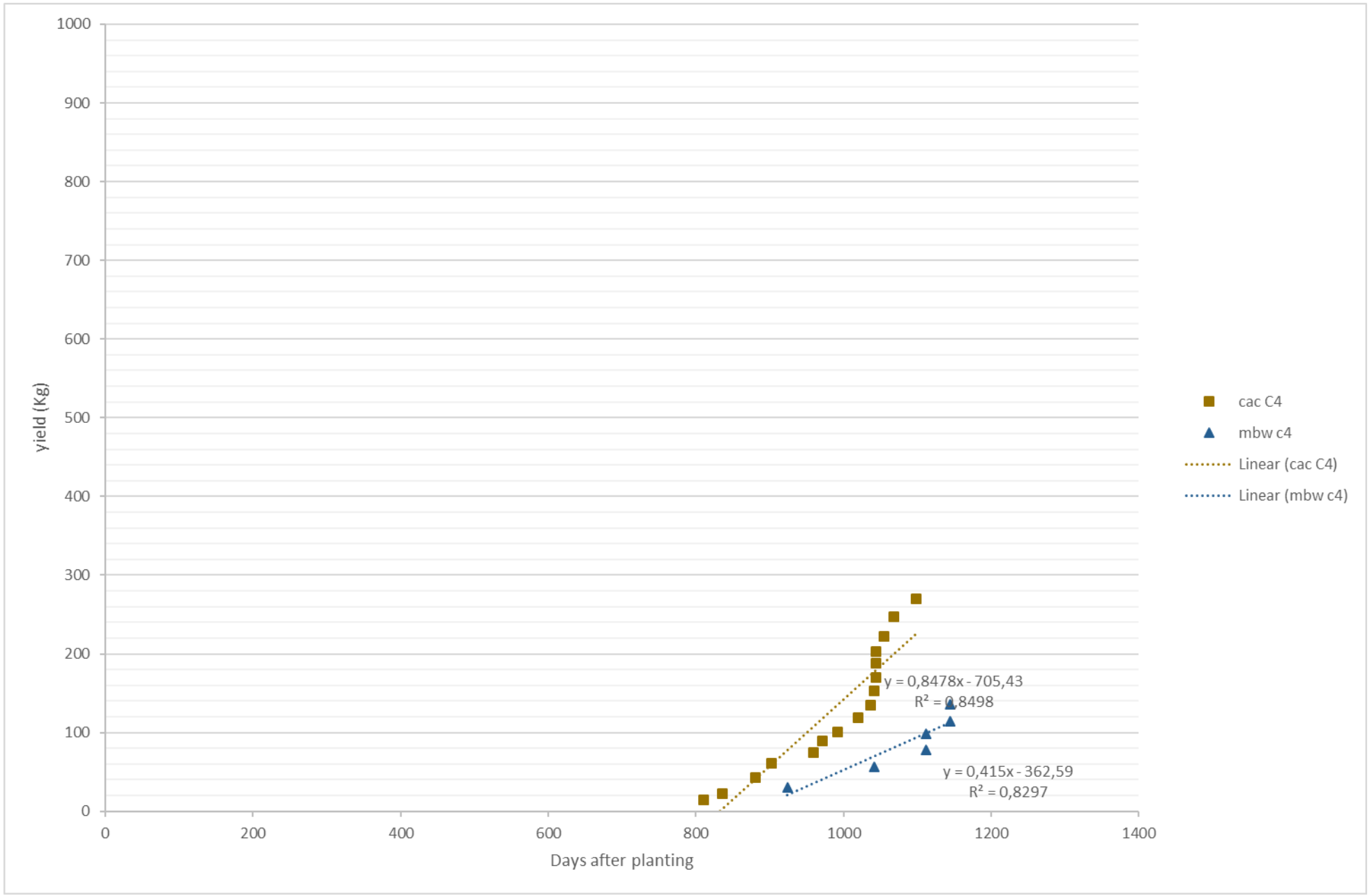

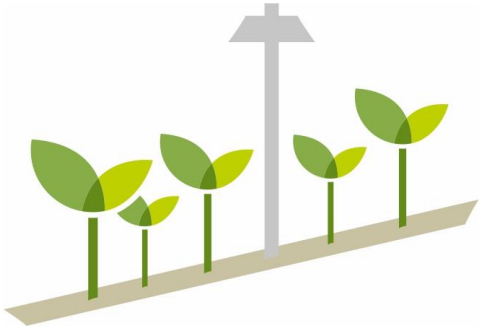

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Partnerships & funding