Deciphering plant resilience mechanisms to face the multiple disease challenge in fruit trees

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Deciphering plant resilience mechanisms to face the multiple disease challenge in fruit trees

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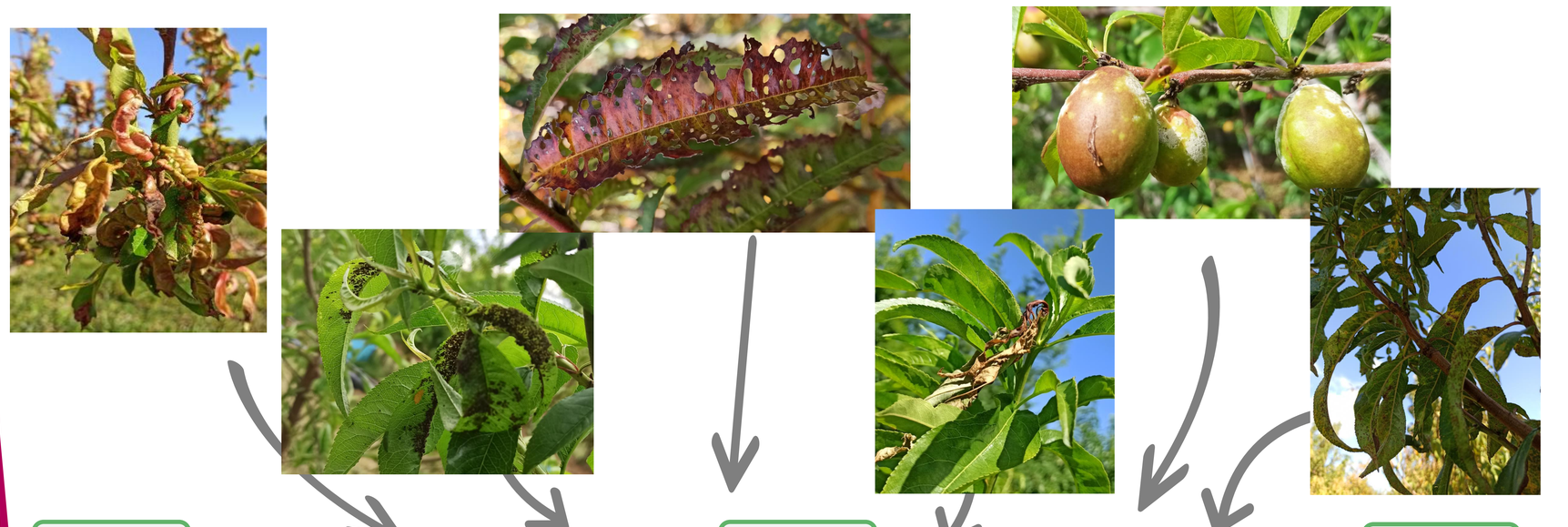


In current cultivated orchards:

- Fluctuating pressures of multiple pests and diseases
- Cumulative effects over the years
- Lack of multi-resistant varieties

→ High dependence on phytosanitary products

Could disease resilience, as a key component of plant immunity, be relevant to study tree survival and fitness in this context?

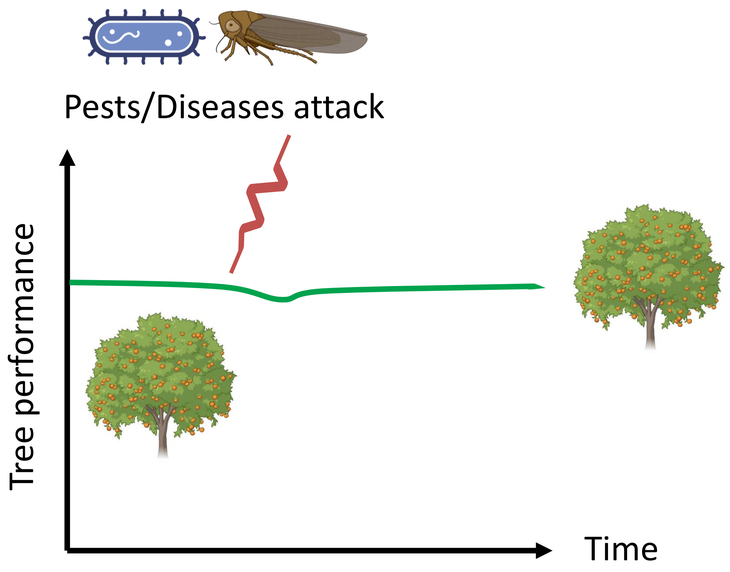
Disease resilient tree

↓

Resistance, Tolerance and Recovery interaction

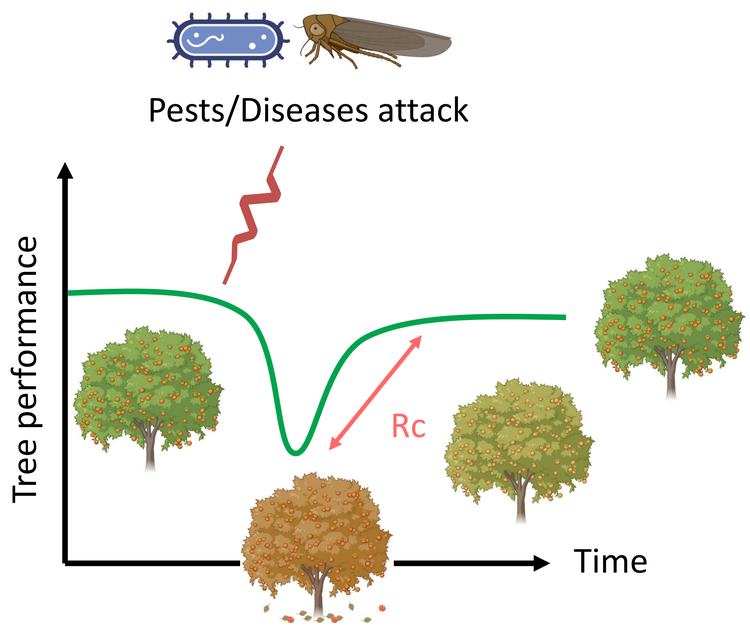
↓

Multiple trajectories over the time involving several biological functions



High **Resistance** or **Tolerance**

OR

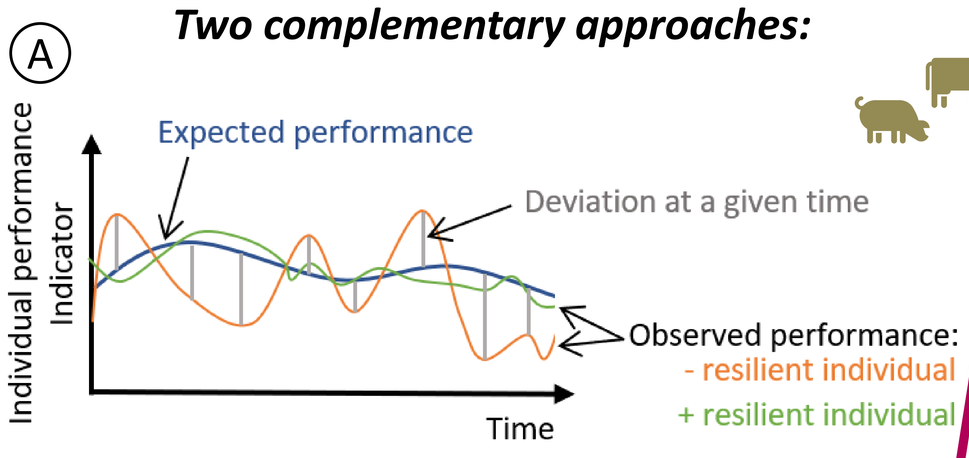


Low Resistance or Tolerance
BUT high **Recovery capacity (Rc)**

What metrics of resilience can be found in literature?

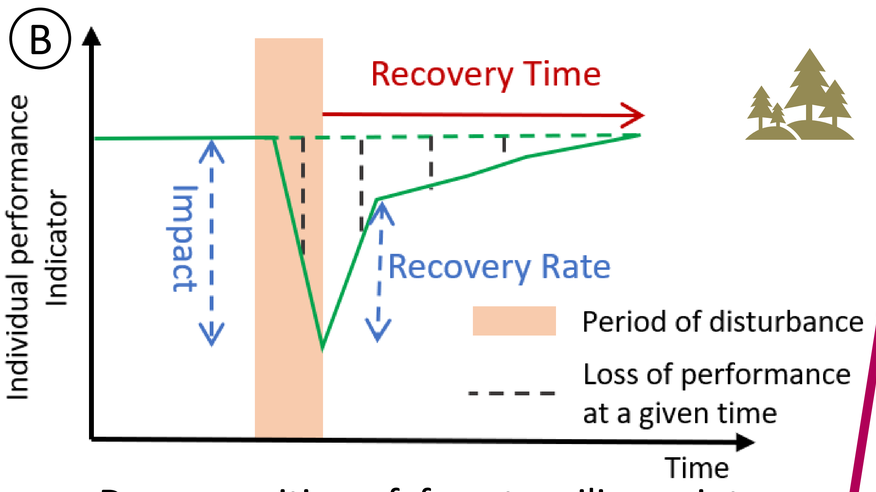
Two complementary approaches:

A



Resilience in livestock[1]:
Measurement of deviations between expected and observed performance over a period of time

B



Decomposition of forest resilience into several **indicators**[2]

How to characterise disease resilience in orchards?

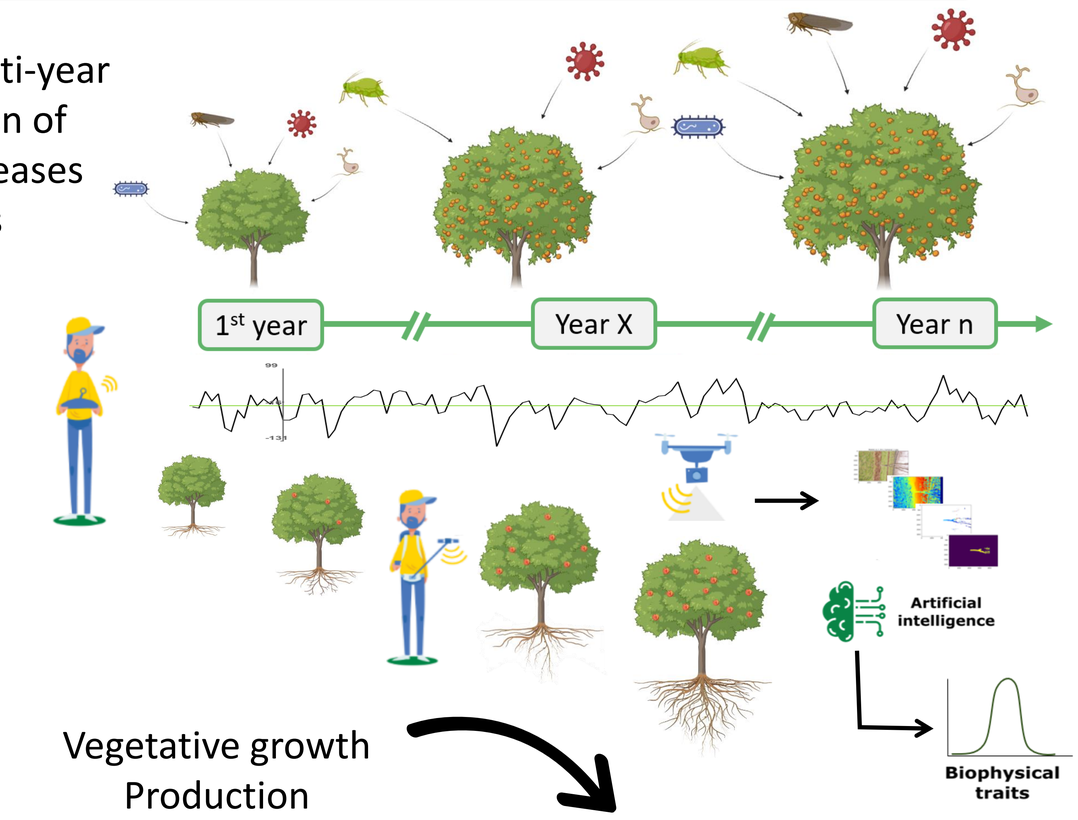
Integrative multi-year quantification of pests and diseases damages

↓

Which are the impacts on tree health?

↓

Temporal measurement of **Resilience Biomarkers**



Vegetative growth
Production
Evapotranspiration
Photosynthetic activity
Omics…

Specific instrumentation: high throughput phenotyping, biological-sensors, digital tools

What is the genetic architecture of disease resilience?

Acquisition of genetic data from large and genetically diverse collections — Genetic analyses: *GWAS, genomic or phenomic prediction* → Identification of **genetic markers** linked to disease resilience components

How to go further?
Let's make disease resilience into a concrete and achievable breeding goal towards resilient ideotypes

[1] Berghof et al. 2019. *Frontiers in genetics 9*, 692.
[2] Lloret et al. 2011. *Oikos 120*(12), 1909-1920; Thurm et al. 2016. *Forest Ecology and Management* 376:205-220.

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