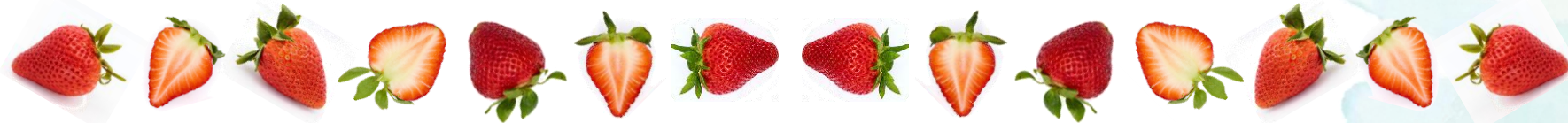


Overview of the Last 10 Years of Disease Resistance Breeding at UC Davis



Dominique Pincot
Assistant Project Scientist
February 10, 2026
UCCE Meeting, Watsonville, CA

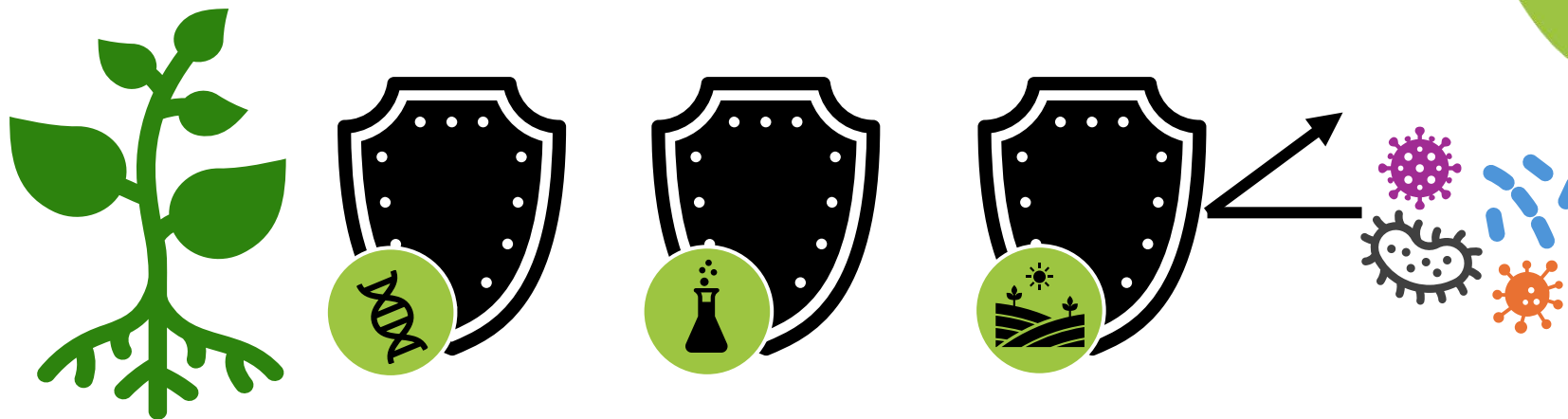
Team Effort

Disease Publications:



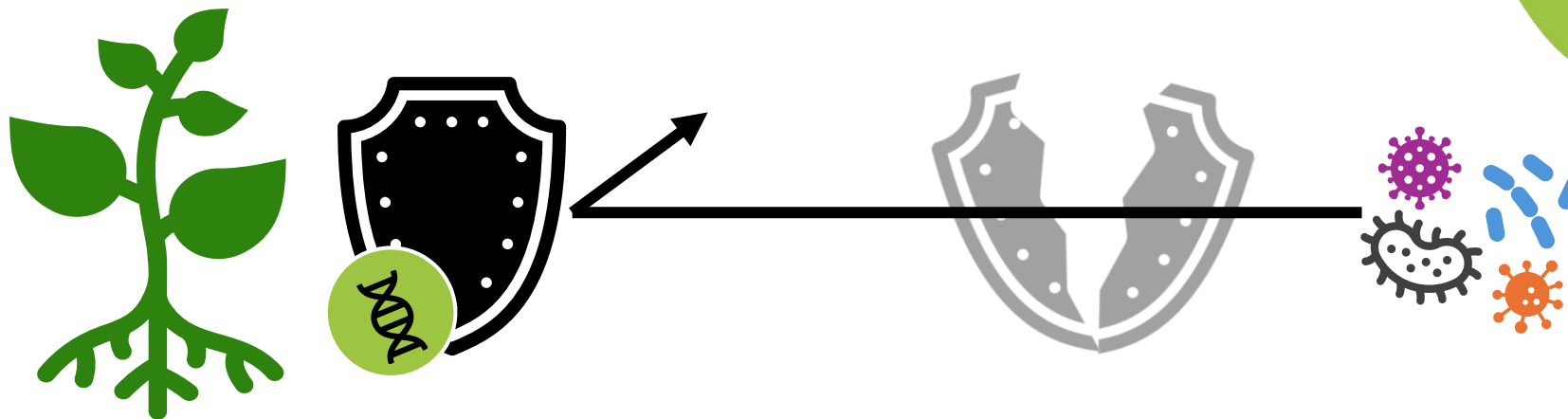
The Importance of Breeding for Resistance

- Genetic resistance is a key part of a complete integrated pest management (IPM) program, complementing the other strategies growers may take, e.g. chemical fumigation.
- Especially important for organic production, where management options are more limited.



The Importance of Breeding for Resistance

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Which Soilborne Pathogens & Diseases?

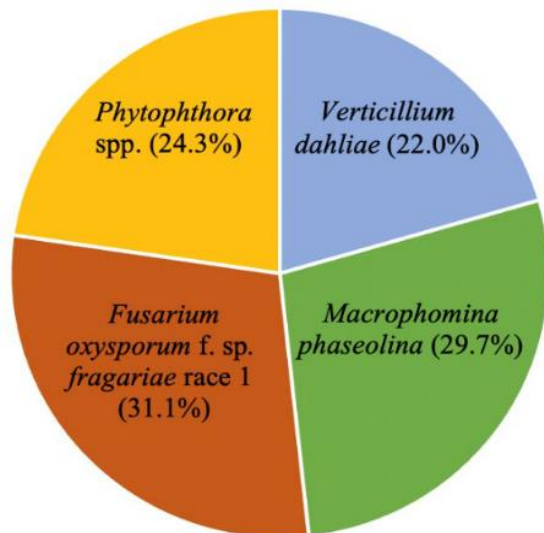
- *Verticillium dahliae*
- *Phytophthora cactorum*
- *Fusarium oxysporum* f. sp. *fragariae*
- *Macrophomina phaseolina*

Verticillium wilt.

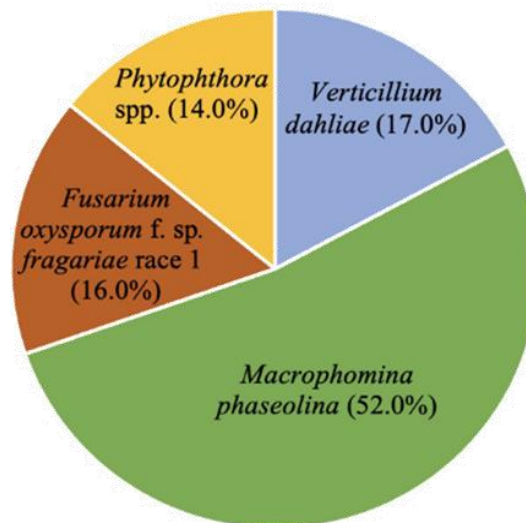
Phytophthora Crown Rot.

Fusarium wilt + Race 2. ★

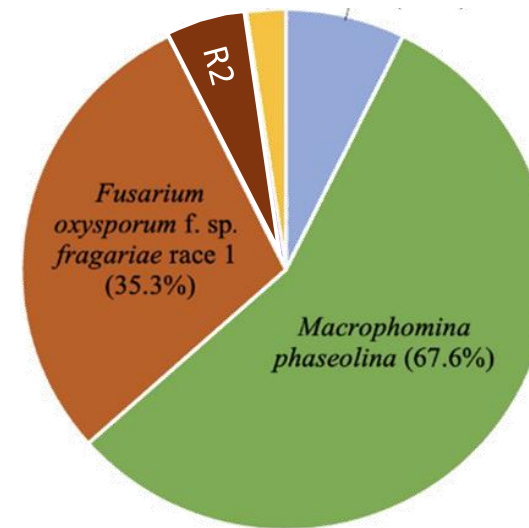
Charcoal Rot. ★



Watsonville



Santa Maria



Oxnard

Made up 68% of the samples submitted to Cal Poly's diagnostic lab in 2025.

How we collect data

- Scores collected from artificially-inoculated plants in-field.
- Ordinal scale adapted from/co-developed with T.R. Gordon.

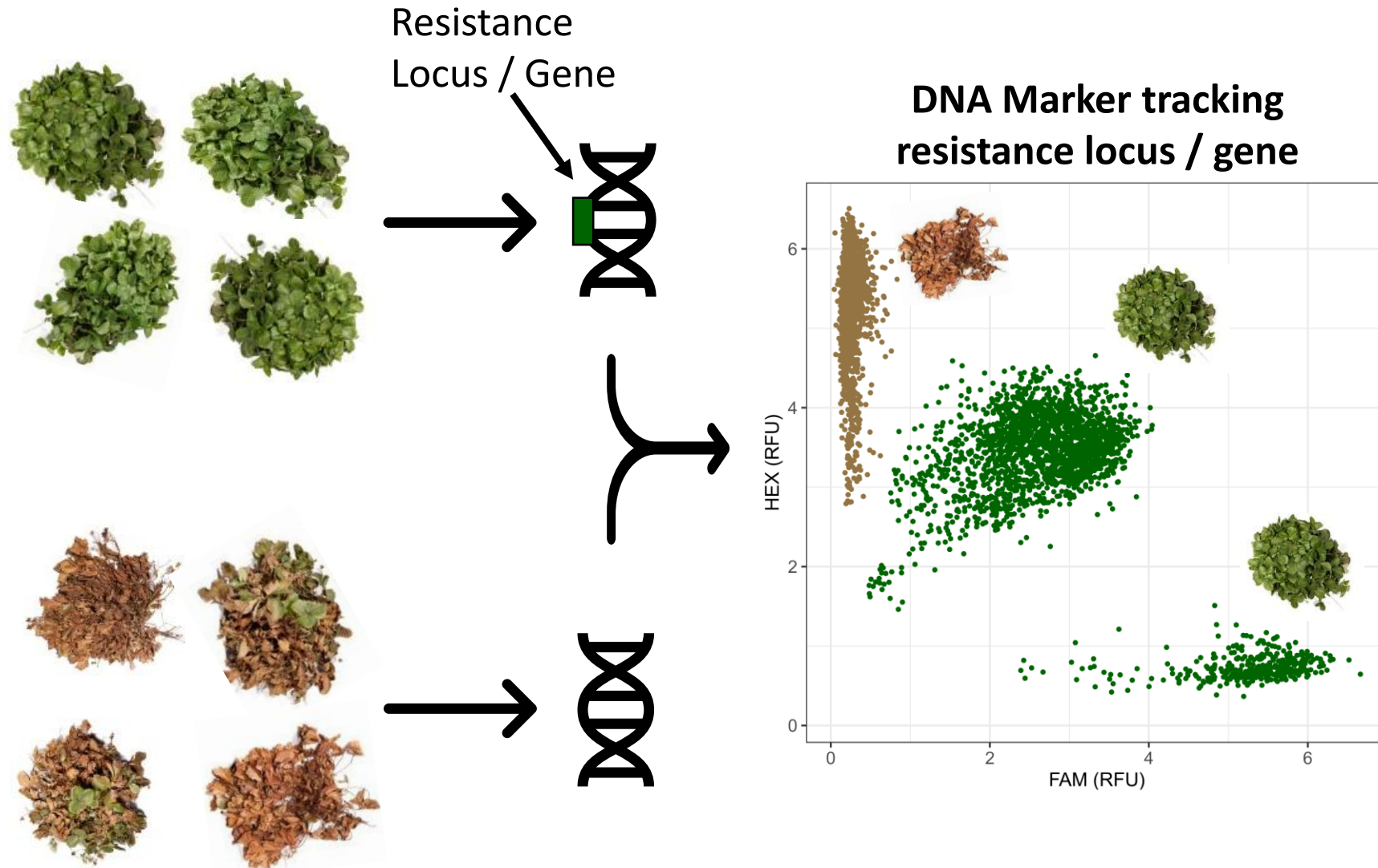


- Potential varieties scored multiple times *per year & across years*.

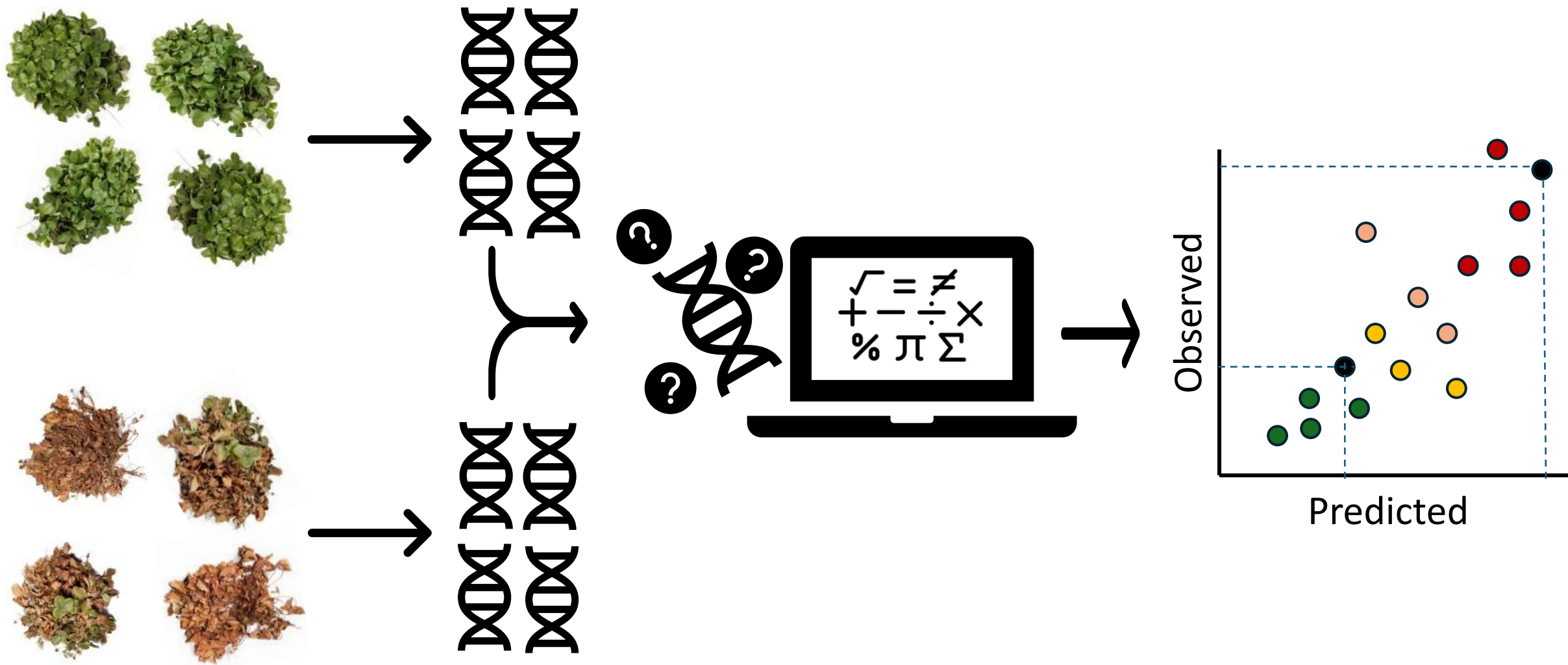
Enabling Modern Breeding Strategies

- More efficient breeding **requires** knowledge about the genetics underlying resistance and/or a lot of data.
 - If genetics known → marker-assisted selection (MAS)
 - If not → genomic prediction & selection (GS)

Marker-Assisted Selection (MAS)



Genomic Prediction & Selection (GS)



Enabling Modern Breeding Strategies

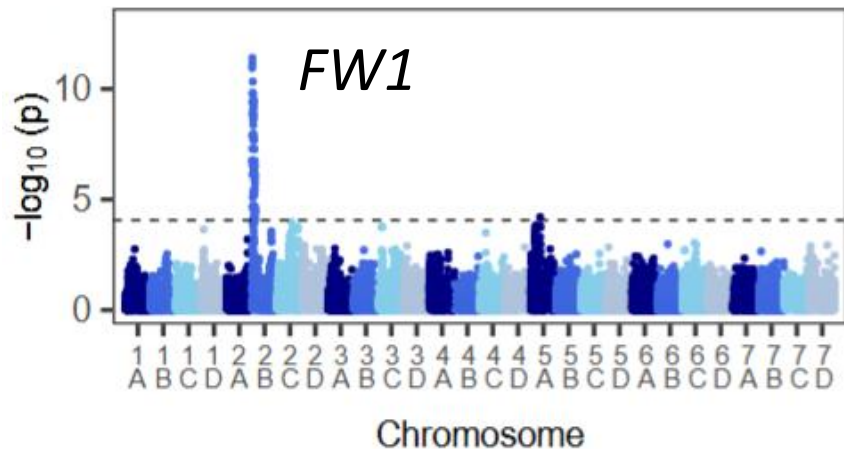
- More efficient breeding **requires** knowledge about the genetics underlying resistance and/or a lot of data.
 - If genetics known → marker-assisted selection (MAS)
 - If not → genomic prediction & selection (GS)



- **Allows** for more efficient targeted selection and culling, allowing us to focus our efforts and resources.
- Any predictions are **always** paired with in-field evaluation/selection.

Improving Fusarium wilt resistance

- Even in 2015, resistance already existed in UCD material (but was rare).
- Caused by a single, large-effect locus.



- Ideal situation for MAS.



Targeting FW-loci Systematically via MAS

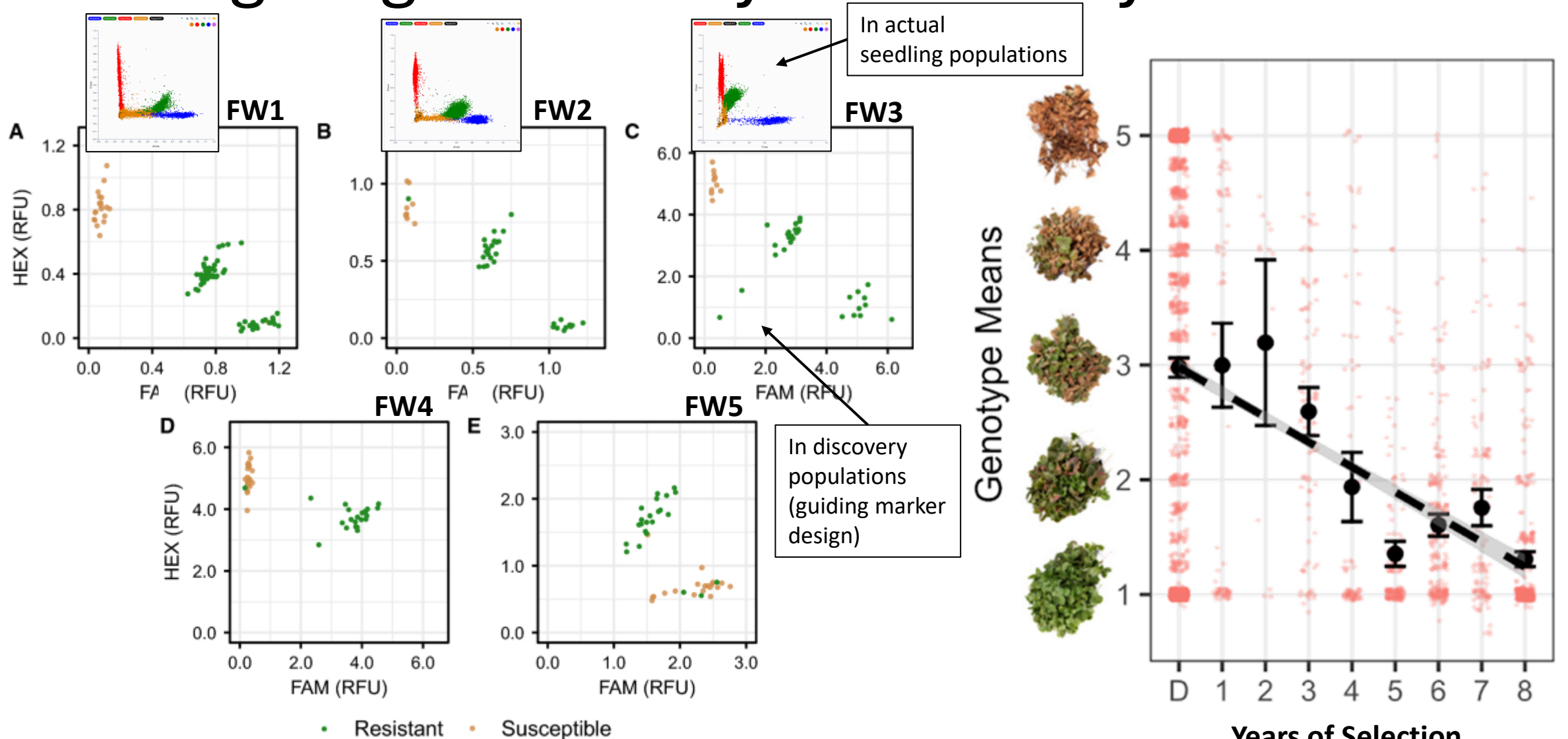
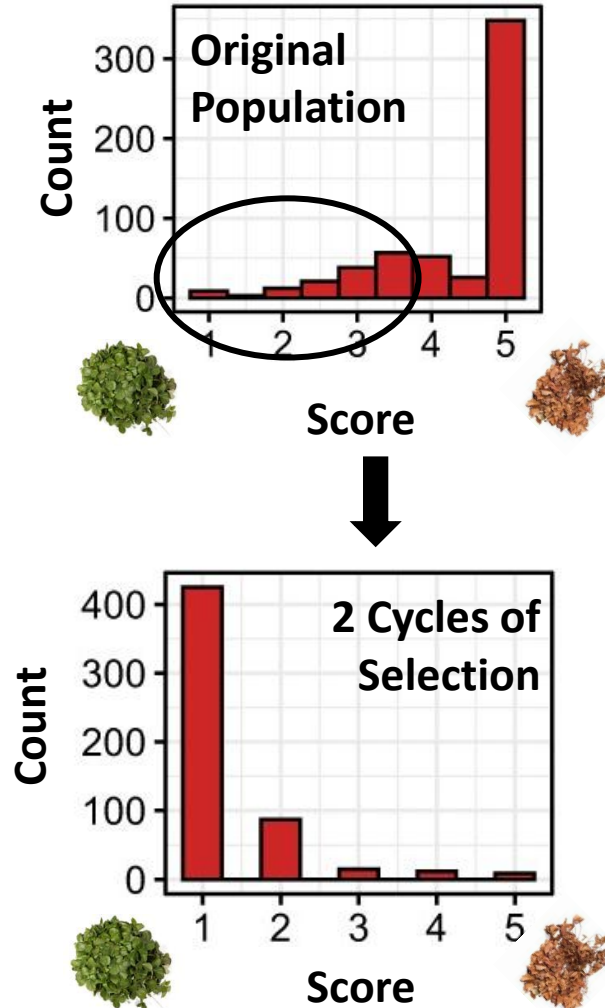
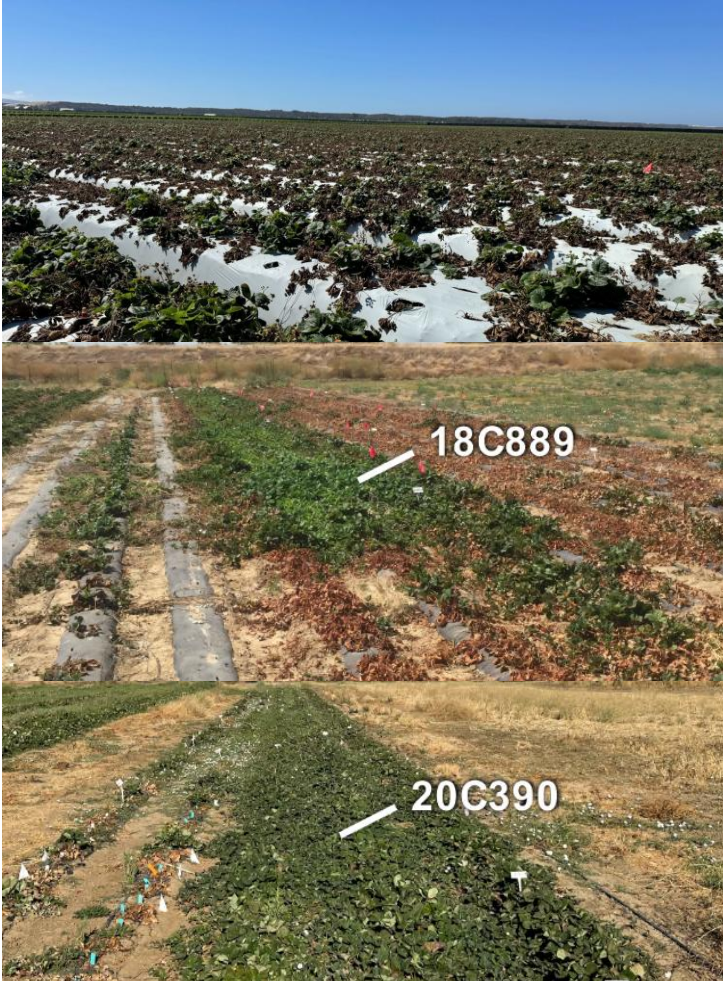


Figure: Pincot et al. (2022); Pincot, Krill-Brown, & Feldmann (2026; forthcoming)

Improving *Macrophomina* Resistance



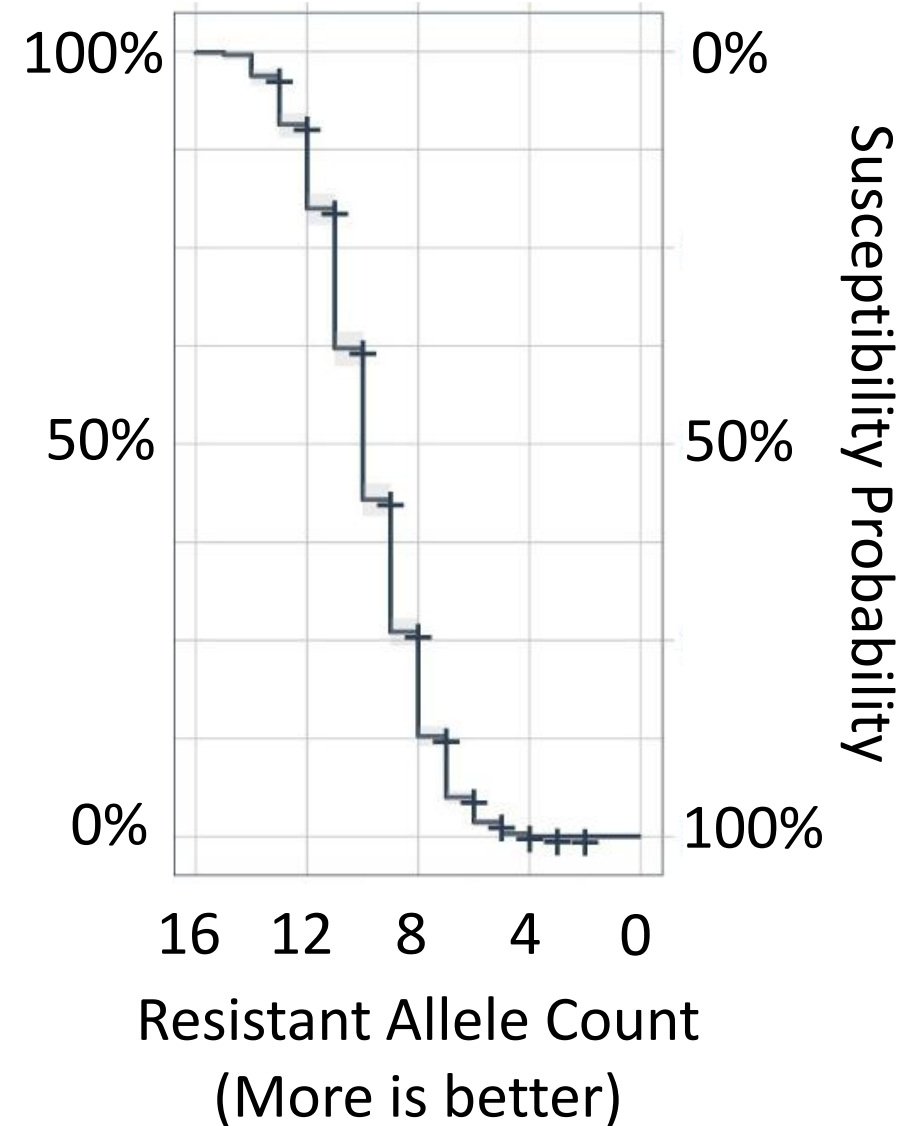
- “Scorched Earth”: resistance was very, very rare in our original population.
- Intercrossing intermediately resistant parents led to some resistant seedlings in the first generation.
- Further intercrossing of these resistant seedlings led to stronger (and more common) resistance.

Summing up Resistance

- *MP1 – MP10*:
 - Partial-resistance loci that must be combined/stacked to obtain a fully resistant plant.
 - The frequency of resistance loci has been increased over generations.
- Breeding for resistance becomes a gene stacking strategy... which is made easier using MAS.

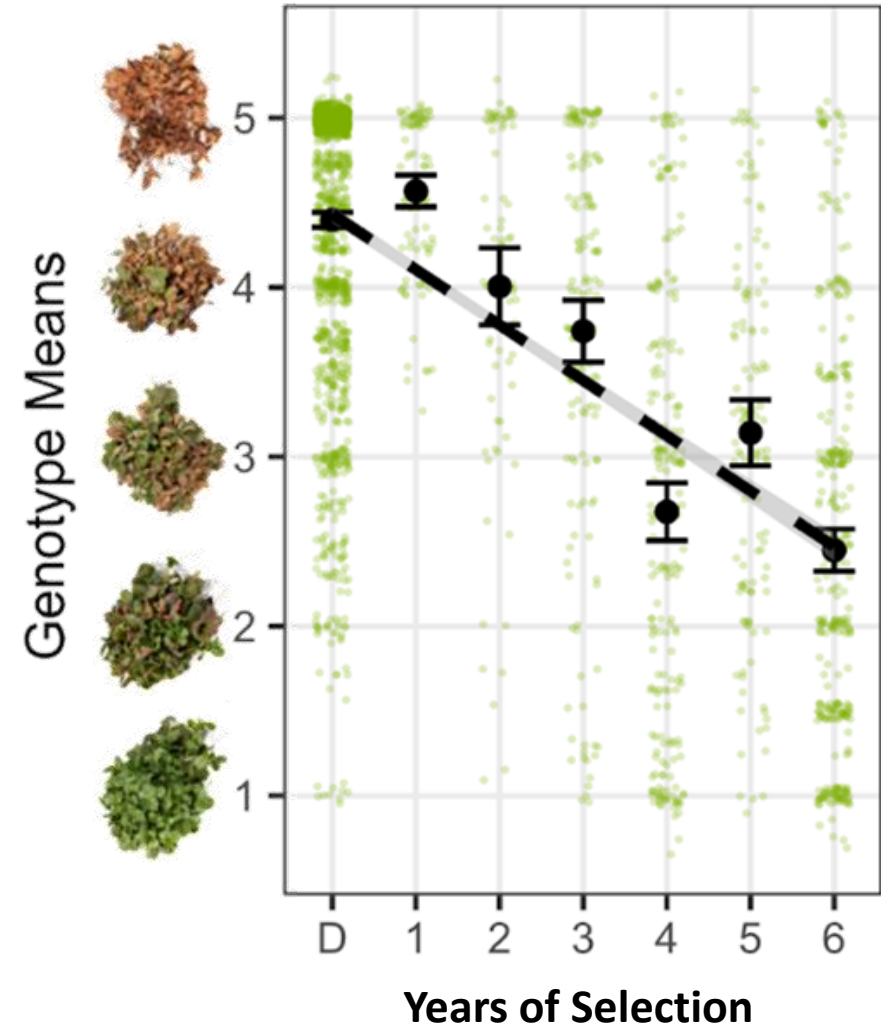


Resistance Probability



Summing up Resistance

- *MP1 – MP10*:
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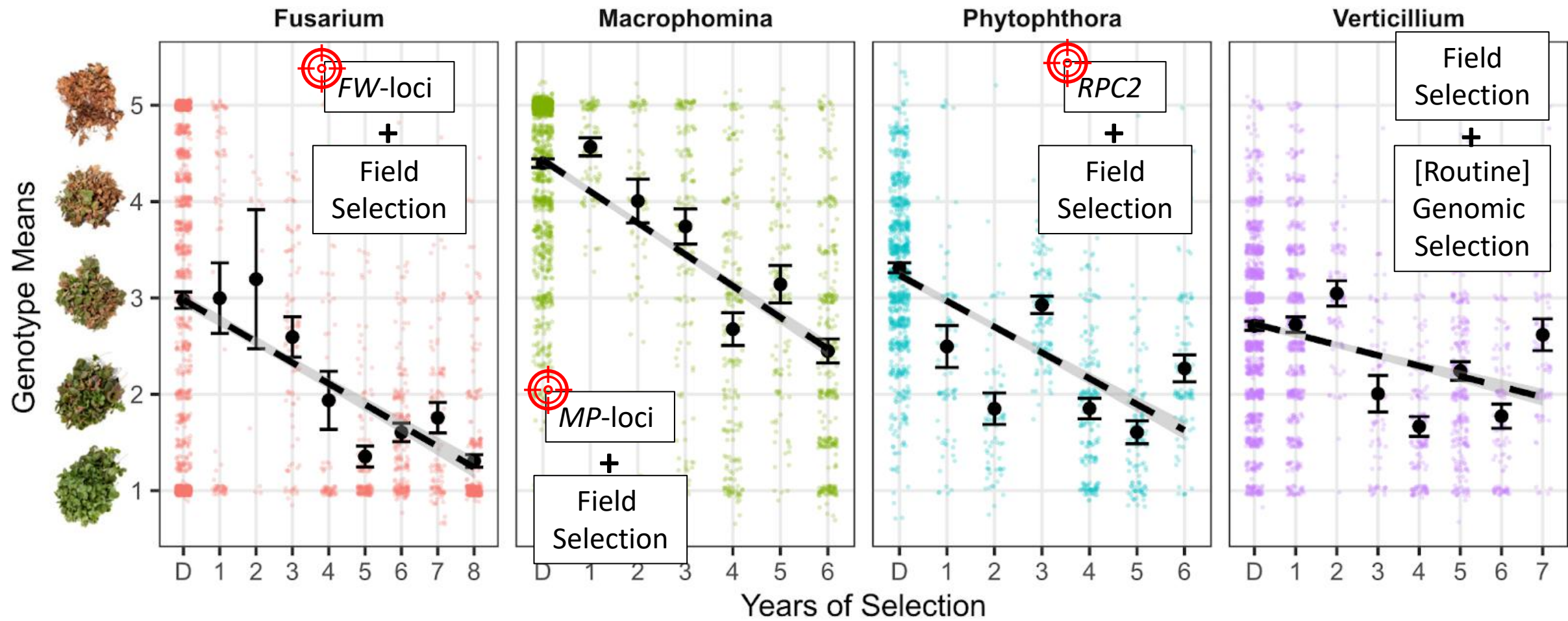


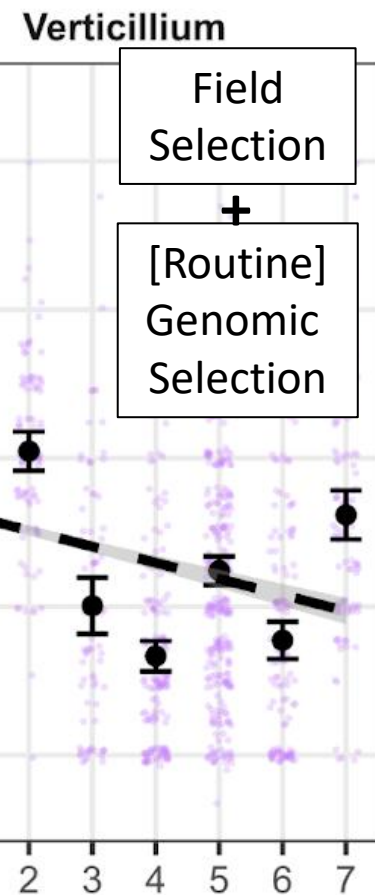
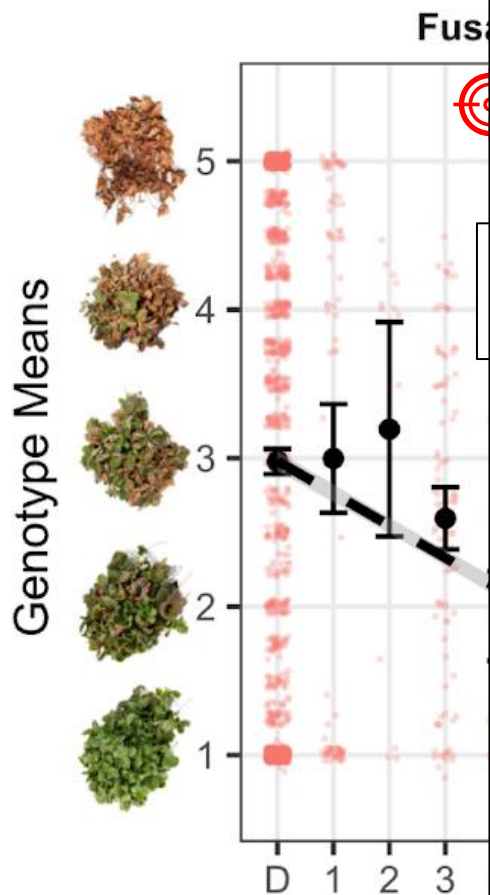
Figure: Pincot, Krill-Brown, & Feldmann (2026; forthcoming); Table: A. Krill-Brown

Ratings from the UCD Strawberry Disease Nursery 2016-2025

Cultivar	Year of release	FUS	MAC	VER	PHY
Chandler	1983	4.0	4.7	2.8	NA
Albion	2004	4.2	4.7	3.3	2.4
Portola	2007	2.1	4.3	3.4	1.6
Monterey	2008	3.3	4.4	2.8	2.4
San_Andreas	2008	1.1	4.8	NA	1.3
Fronteras	2014	1.4	4.2	2.7	2.4
Cabrillo	2015	4.0	4.3	2.8	1.9
UCD_Moxie	2019	1.8	4.5	2.6	2.7
UCD_Royal_Royce	2019	3.6	3.6	2.6	2.4
UCD_Valiant	2019	3.3	4.0	2.6	2.2
UCD_Victor	2019	1.4	4.3	3.0	1.9
UCD_Warrior	2019	1.1	2.7	2.6	1.8
UCD_Finn	2021	4.5	5.0	2.8	2.8
UCD_Mojo	2021	2.9	2.6	2.2	2.4
UC_Eclipse	2023	1.2	3.8	2.6	2.3
UC_Golden_Gate	2023	1.7	4.0	2.7	2.5
UC_Keystone	2023	1.3	3.9	2.4	2.3
UC_Monarch	2023	1.3	2.2	2.0	1.8
UC_Surflin	2023	1.0	3.1	1.5	1.4

*ratings on a 1-5 scale (1= resistant, 5=dead)

Chart updated yearly on strawberry.ucdavis.edu



So that's been the past decade!

What about the future?



Fusarium Race 2 Resistance



USDA
Agricultural
Research
Service

- We have recovered resistant plants & have validated resistance across clonal generations, but further breeding is needed.
- We are still investigating the underlying genetics. Publication expected this year.
- We have created a screening protocol so that we can screen more seedlings & advance through generations more quickly.



Photos: Morgan-Bailey, Pincot

Foliar and Fruit Diseases



- Angular Leaf Spot (*Xanthomonas fragariae*) : Publication in review.
 - 2 loci that could be used for marker-assisted selection.
- Powdery Mildew (*Podosphaera aphanis*)
- NPT Leaf, Fruit, & Crown Rot (*Neopestalotia* spp.)
- Grey Mold (*Botrytis cinerea*)

ONGOING



Thank you! Questions?

Upcoming Review about all this work in *California Agriculture*

Disease Publications:

