

Spread of lettuce Fusarium wilt to coastal production regions and identification of a new race

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Lettuce Fusarium wilt – Field symptoms



Usually first appears as a patch in the middle of a field

Lettuce Fusarium wilt – Field symptoms




That later expands

Lettuce Fusarium wilt – Foliar symptoms



Can appear very early
Stunting of plant
and/or head
Wilting, yellowing of
outer leaves
Death
Plants end at
different sizes (or
are killed as
seedlings)

Lettuce Fusarium wilt – Foliar symptoms



Disclaimer: Foliar symptoms are not diagnostic

Can appear very early
Stunting of plant
and/or head
Wilting, yellowing of
outer leaves
Death
Plants end at
different sizes (or
are killed as
seedlings)

Lettuce Fusarium wilt – Root symptoms



No symptoms on the outside—roots appear healthy

Internal symptoms affecting vascular tissue



Healthy



Discoloration



Hollowing out



Rot, white residue

Internal symptoms affecting vascular tissue

Disclaimer: Internal symptoms, particularly color, are not diagnostic



Healthy



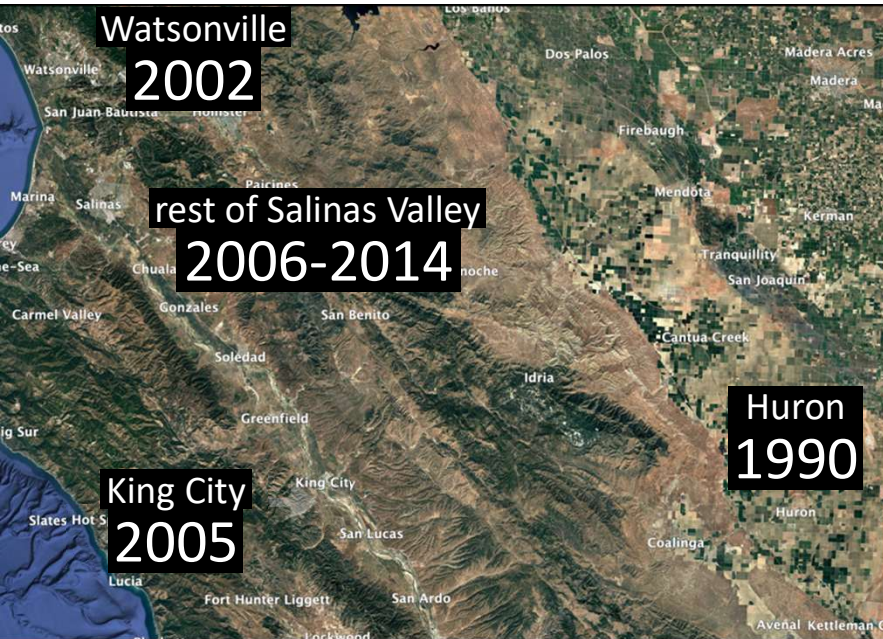
Discoloration



Hollowing out

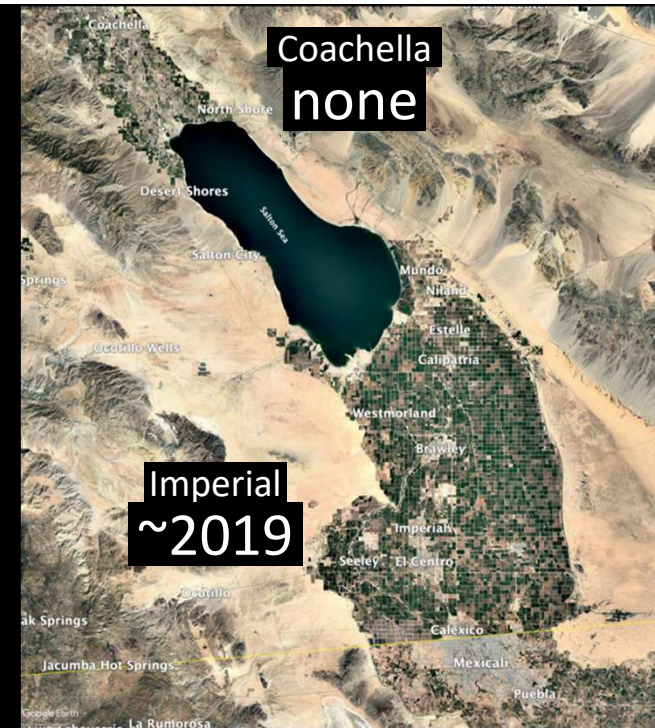


Rot, white residue



Timeline of first detections

Adapted from S. Koike



Current Status

Adapted from S. Koike



Fusarium is spread by infested soil



farmersalmanac.com



G. Holmes, Cal Poly SLO, Bugwood.org



A teaspoon of soil can contain hundreds of resting spores



Santa Barbara Co. Ag. Commish



G. Holmes, Cal Poly SLO, Bugwood.org

Fusarium oxysporum f. sp. *lactucae* (FOL)

- Disease-causing ability is host specific
 - *F. oxysporum* f. sp. *lactucae* will only cause disease of lettuce
 - f. sp. = “special form”
- Can grow and reproduce on:
 - Plants on which it cannot cause disease
 - Resistant varieties of its host plant
- There are many special forms of other hosts
 - Also, there are probably many *F. oxysporum* populations that are non-pathogenic

Host Range of Fusarium strains

Lettuce



f. sp. lactucae

Celery



f. sp. apii

Cilantro



f. sp. coriandrii

Strawberry



f. sp. fragariae

Can cause disease to...

Lettuce

Celery
Cilantro

Cilantro

Strawberry

Can grow on roots of...

Broccoli
Cauliflower
Spinach
Probably others

Probably many crops
(but not tested)

Probably many crops
(but not tested)

Broccoli
Cilantro
Lettuce
Raspberry
Spinach
Wheat
Probably others

Pathogenic races of FOL

Variety	race 1	race 2	race 3	race 4
Patriot	S	S	S	IR
Costa Rica No. 4	HR	S	S	S
Romana Romabella	HR	HR	S	IR
Banchu Red Fire	S	HR	S	IR

HR = highly resistant; IR = intermediate resistance; S = susceptible

Race = unique pattern of resistant or susceptible reactions on different varieties

Four races of FOL have been identified worldwide

- 1: Japan, Europe, South America, North America (Florida, California, Arizona)
- 2: Japan
- 3: Japan, Taiwan
- 4: Europe (several countries)

Salinas Valley

Three different locations

Pattern A



Pattern B



Pattern B



Patriot

Stage Coach

Variety 1

Variety 2

Variety 3

Variety 4

Costa Rica

Red Fire

New Race of FOL

Variety	Our Research					
	race 1	race 2	race 3	race 4	race 1	Costa Rica #4 variant*
Patriot	S	S	S	IR	S	S
Costa Rica No. 4	HR	S	S	S	HR	S
Romana Romabella	HR	HR	S	IR	HR	HR
Banchu Red Fire	S	HR	S	IR	S	S

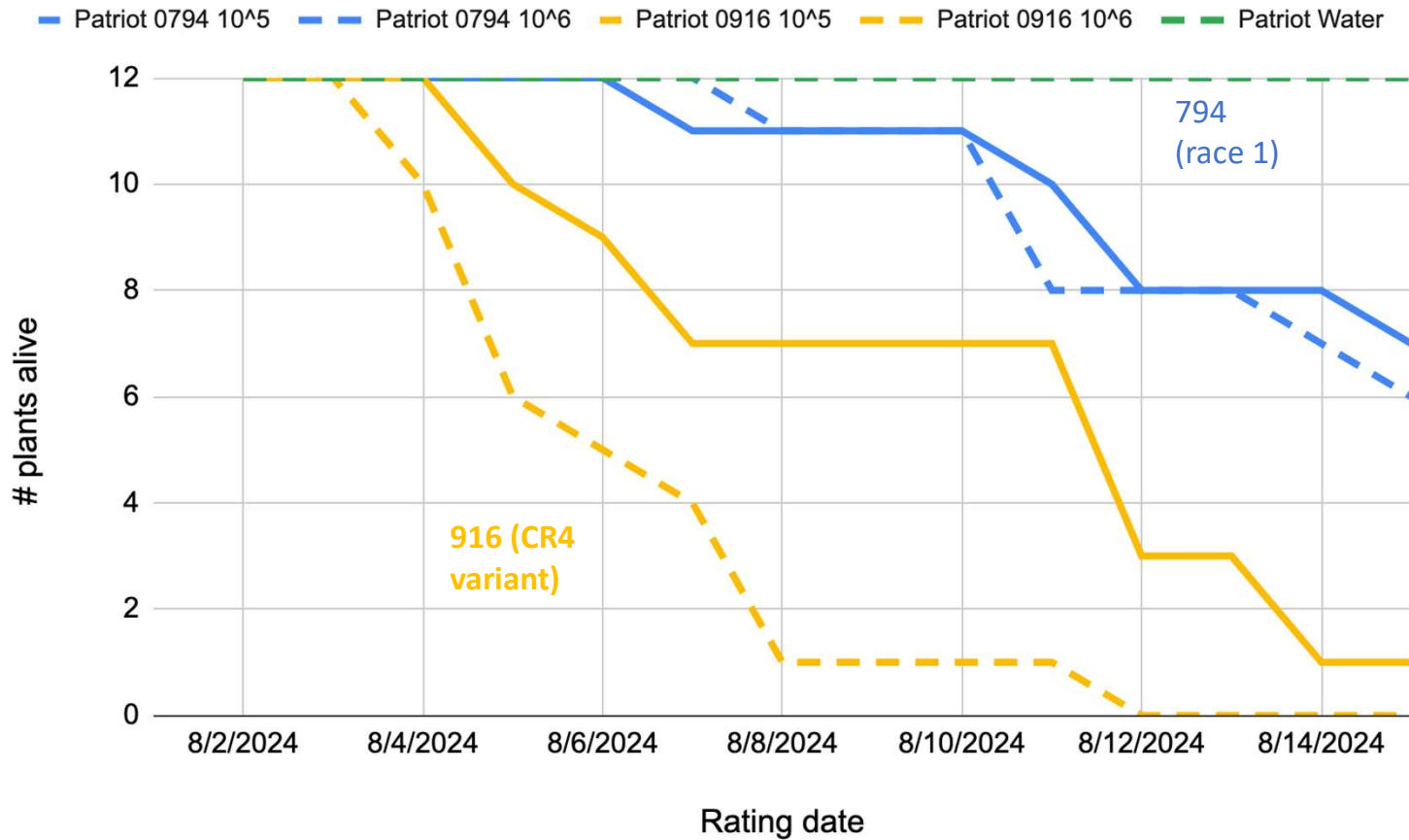
HR = highly resistant; IR = intermediate resistance; S = susceptible

* “Costa Rica #4 variant” (“CR4 variant” for short) is a temporary name we are using for the novel race of FOL until it is officially verified and named in the upcoming ring test

Detected in 4 fields in Santa Maria and 3 fields in Salinas Valley

At two locations, both races were found in the same field (but not necessarily the same spot)

Apparent differences in aggressiveness between races



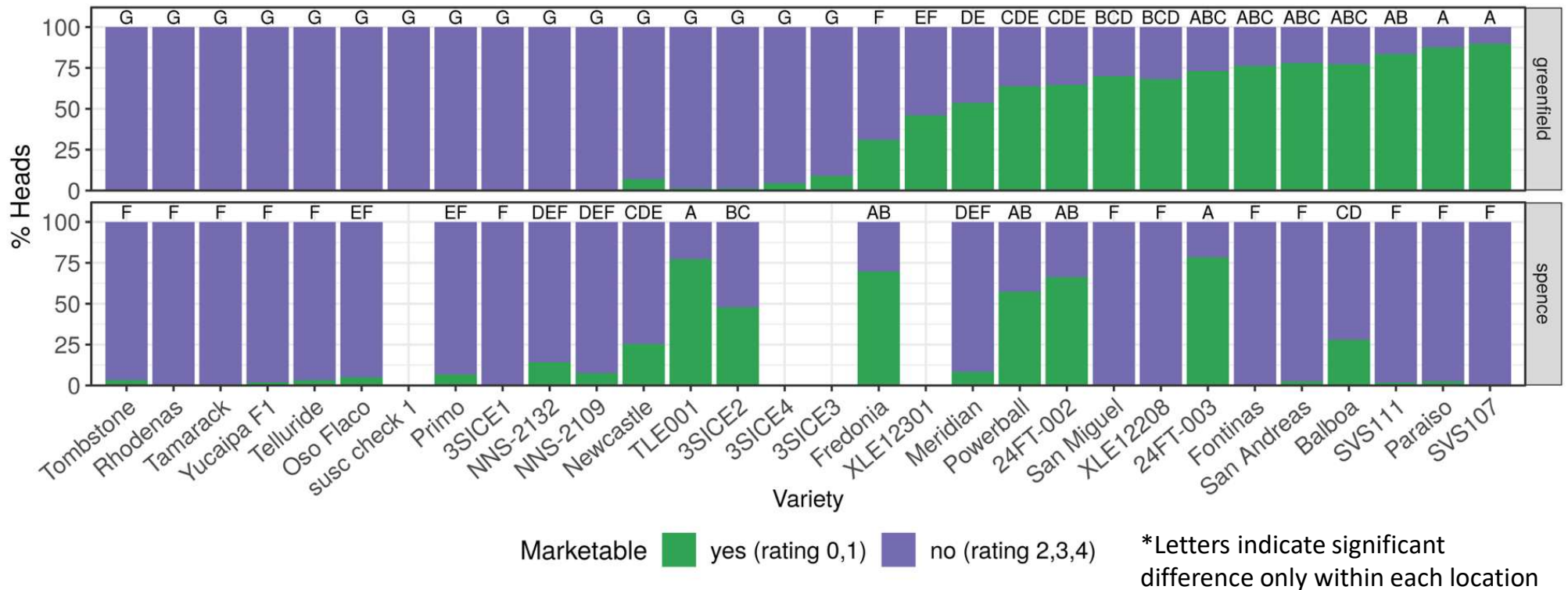
Greenhouse pots

In variety susceptible to both races, CR4 variant isolate kills more plants and faster than race 1 isolate

Management

- Sanitation: Prevent movement of soil from fields with Fusarium wilt history
 - Especially equipment from other production regions
- Crop rotation: longer the better
- Planting date: avoid hot temperatures within 3 weeks of emergence
- Tolerant varieties
 - Icebergs most susceptible on average
 - Romaines most tolerant on average

Fusarium wilt variety trial 2024 – Iceberg

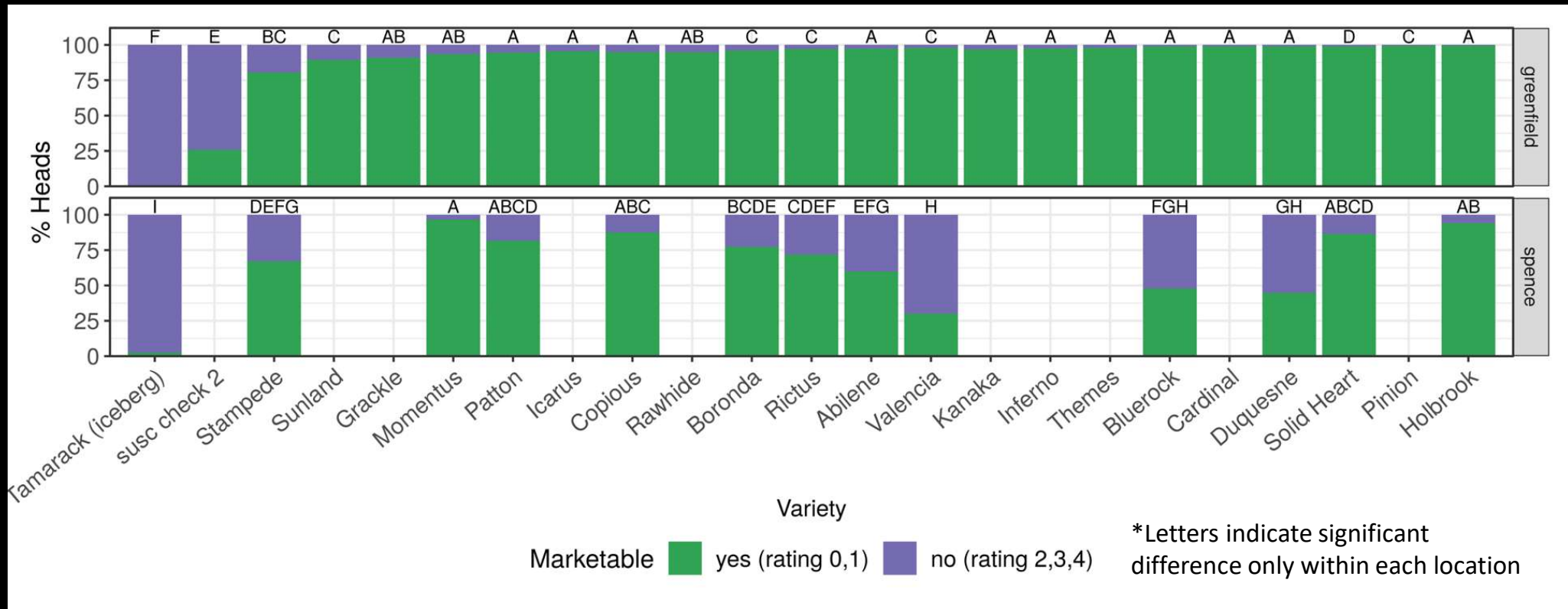


Greenhouse race phenotyping

Greenfield = CR4 variant; Spence not yet confirmed

NOTE: Spence location not farmed to commercial lettuce standards

Fusarium wilt variety trial 2024 – Romaine



Greenhouse race phenotyping

Greenfield = CR4 variant; Spence not yet confirmed

NOTE: Spence location not farmed to commercial lettuce standards

Fusarium wilt of lettuce – Summary

- The CR4 variant is a novel race that is present on the Central Coast
- Race 1 is also present on the Central Coast
- Use sanitation to prevent spread to Ventura
- Rotate out of lettuce

Project Team and Acknowledgements

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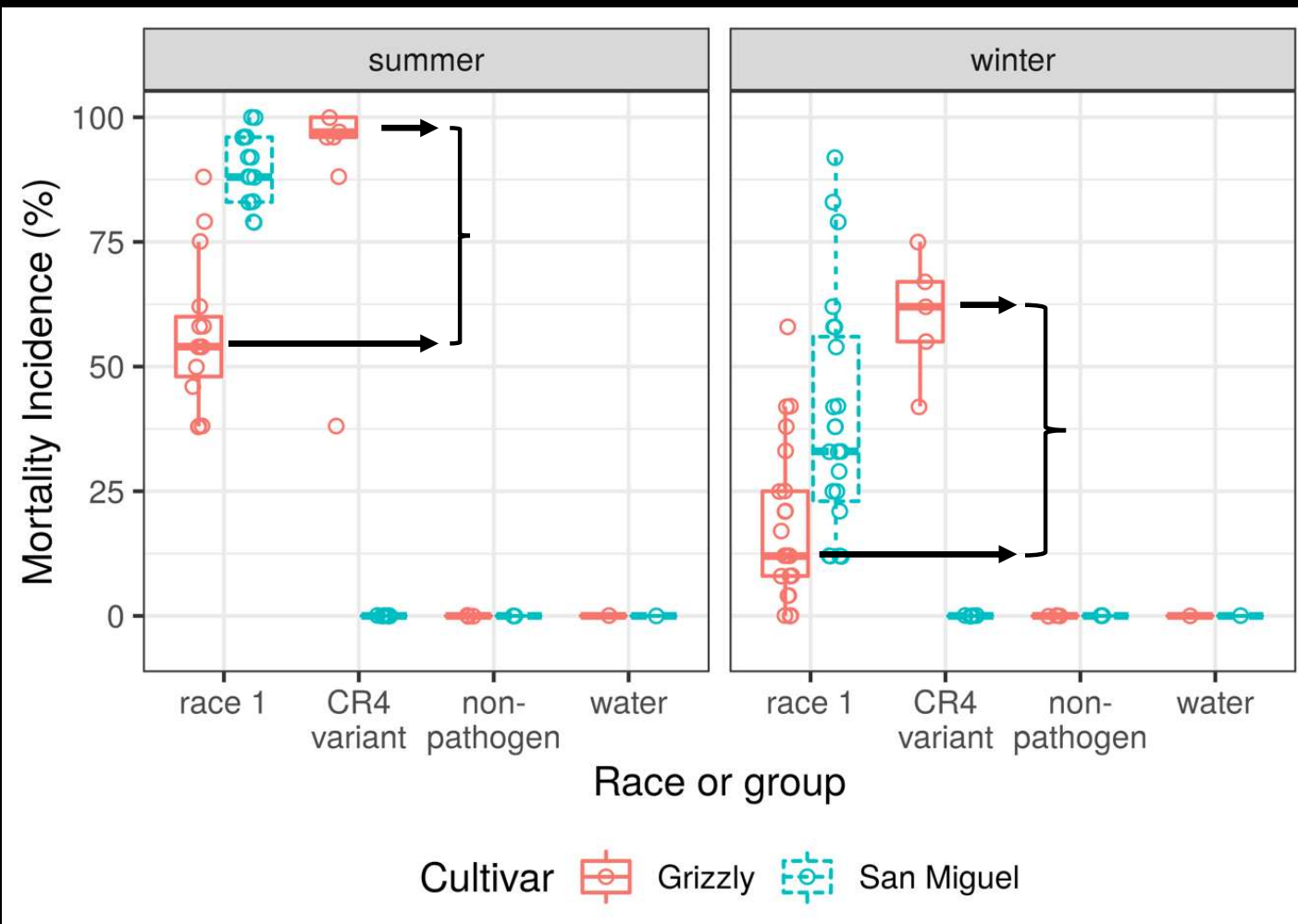
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Program (PD Putman)



Quantitative differences among races? (in greenhouse)



Apparent difference in aggressiveness to Grizzly between race 1 and the CR4 variant

Disease pressure lower for experiments done in winter

- Each point = 1 isolate
- Isolates between summer/winter not same

% mortality of 24 plants