Host resistance for managing soilborne diseases in strawberry production

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Cal Poly Strawberry Center

&

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Cal Poly Strawberry Center
### NEXT GENERATION DISEASE RESISTANCE BREEDING

<table>
<thead>
<tr>
<th>Disease Common Name</th>
<th>FL</th>
<th>SD-CA</th>
<th>DN-CA</th>
<th>NP</th>
<th>R-Gene</th>
<th>QTL</th>
<th>Complex</th>
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<td>?</td>
<td>+</td>
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<td>Anthracnose</td>
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<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>FaRca2</td>
<td>?</td>
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<td>Phytophthora crown rot</td>
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<td>FaRPc2</td>
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<td>Powdery mildew</td>
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<td>Angular leaf spot</td>
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<td>FaRXf1</td>
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<td>N</td>
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<td>3</td>
<td>FaCg1, FaCg2</td>
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</table>

1 = highest priority; 2 = medium priority; 3 = lowest priority; N = non-priority.
SD = short-day, DN = day-neutral, and NP = nursery production.

*R-gene* = resistance gene, *QTL* = large-effect quantitative trait locus, complex = polygenic, complex genetics, and ? = unknown or hypothesized.
Fields infested on the campus of Cal Poly:

*Macrophomina phaseolina*

*Verticillium dahliae*
Field infested at the Monterey Bay Academy:

*Fusarium oxysporum f.sp. fragariae*
Cal Poly Trials

6 breeding programs
90 genotypes
• 30 cultivars
• 60 elite selections
Fields infested on the campus of Cal Poly:

*Macrophomina phaseolina*
MACROPHOMINA TRIAL

March 1, 2017
MACROPHOMINA TRIAL

August 1, 2017
Average Percent Mortality due to Macrophomina Crown Rot as of July 24, 2017

MACROPHOMINA CROWN ROT

SUSCEPTIBILITY
MACROPHOMINA CROWN ROT SUSCEPTIBILITY

Monterey: 69% dead
MACROPHOMINA CROWN ROT Susceptibility

Albion: 52% dead
Portola: 40% dead
San Andreas: 27% dead
MACROPHOMINA CROWN ROT SUSCEPTIBILITY

Average Percent Mortality due to Macrophomina Crown Rot by Breeding Program as of July 24, 2017
Fields infested on the campus of Cal Poly:

*Macrophomina phaseolina*

*Verticillium dahliae*
VERTICILLIUM TRIAL

March 21, 2017
VERTICILLIUM WILT SUSCEPTIBILITY

Albion 10% dead
**VERTICILLIUM WILT SUSCEPTIBILITY**

San Andreas: 8% dead
VERTICILLIUM WILT SUSCEPTIBILITY
# VERTICILLIUM TRIAL 2015

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Disease incidence (% plant mortality)</th>
<th>Yield (g/plant)</th>
<th>Early season</th>
<th>Late season</th>
<th>Total</th>
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<td>12 Jun</td>
<td>11 Sep</td>
<td>AUDPC&lt;sup&gt;y&lt;/sup&gt;</td>
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<td>46.0 b</td>
<td>2409.6 c</td>
<td>709.2 bc</td>
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<td>San Andreas</td>
<td>10.1 bc</td>
<td>34.7 b</td>
<td>2623.4 c</td>
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<td><strong>P Values</strong></td>
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<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
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</table>

*<sup>x</sup>*: Significant at the 0.05 level.
*<sup>y</sup>*: Significant at the 0.01 level.
*<sup>z</sup>*: Significant at the 0.001 level.
Field infested at the Monterey Bay Academy:

*Fusarium oxysporum* f.sp. *fragariae*
FUSARIIUM TRIAL 2015
This is a map of Rep I in the MBA variety trial, where the soilborne fungus *Fusarium oxysporum* f. sp. *fragariae* is established. Each area surrounded by black lines represents one bed of a different strawberry cultivar (cultivar name listed at the top of each bed). Light orange color = leaf necrosis; burnt orange color = dead strawberry plant.
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FUSARIUM TRIAL 2015

Percent Mortality on July 23, 2015

- Sweet Ann: 96.5%
- Monterey: 75.7%
- Radiance: 55.2%
- Albion: 53.2%
- Sabrina: 33.3%
- Grenada: 32.3%
- Sensation: 26.7%
- Winterstar: 16.4%
- Ventana: 9.9%
- San Andreas: 4.1%
- Festival: 2.3%
- Portola: 1.7%
- Safari: 0.9%
- Fronteras: 0.6%
- Petaluma: 0.3%
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Monterey: 75% dead
FUSARIUM TRIAL 2015

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- Safari: 0.9%
- Fronteras: 0.6%
- Petaluma: 0.3%

Portola: 2% dead
<table>
<thead>
<tr>
<th>CULTIVAR</th>
<th>Fusarium wilt</th>
<th>Verticillium wilt</th>
<th>Macrophomina crown rot</th>
<th>Phytophthora</th>
<th>Anthracnose</th>
<th>Fruit diseases</th>
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CONCLUSIONS

High levels of resistance

Wide range of susceptibility in germplasm

Strawberry Center to continue host resistance screening for additional diseases...
THANKS TO...

CALIFORNIA STRAWBERRY COMMISSION

UCDAVIS UNIVERSITY OF CALIFORNIA

Plant Sciences Inc. Advancing Agriculture through Science®

UF UNIVERSITY OF FLORIDA

PLANASA INNOVATION IN PLANT VARIETIES

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TriCal INC.

Lassen Canyon Nursery, Inc.