Field Evaluation of Host Plant Resistance in Strawberry Against Verticillium Wilt, Macrophomina Crown Rot and Fusarium Wilt

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NEXT-GEN DISEASE RESISTANCE BREEDING

Disease Common Name	FL	SD-CA	DN-CA	NP	*R*-Gene	QTL	Complex
Charcoal rot	1	1	1	1		?	+
Fusarium wilt	N	1	1	1	*FaFo2A*		
Verticillium wilt	N	2	2	1		?	+
Anthracnose	1	3	3	2	*FaRca2*	?	
Phytophthora crown rot	2	3	3	2		*FaRPc2*	
Powdery mildew	2	3	3	2		+	+
Angular leaf spot	2	3	3	2	*FaRXf1*		
Colletotrichum crown rot	3	N	N	3		*FaCg1*, *FaCg2*	

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.

VERTICILLIUM TRIAL 2015

Cultivar	Disease incidence (% plant mortality)[z]		AUDPC[y]	Yield (g/plant)[z]		
	12 Jun	11 Sep		Early season[xz]	Late season[vz]	Total[uz]
Portola.....	44.4 a	98.4 a	8536.3 a	652.6 c	21.9 b	674.5 c
Monterey.....	27.8 ab	89.9 a	6572.5 b	759.3 b	69.6 b	828.9 b
Albion.....	4.8 c	46.0 b	2409.6 c	709.2 bc	136.5 a	845.7 b
San Andreas.....	10.1 bc	34.7 b	2623.4 c	923.5 a	170.9 a	1094.4 a
P Values	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

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Location	Cal Poly Field 25	Cal Poly Field 35b	Monterey Bay Academy
Disease	Verticillium wilt	Macrophomina crown rot	Fusarium wilt
Inoculum	Natural	Artificial	Natural

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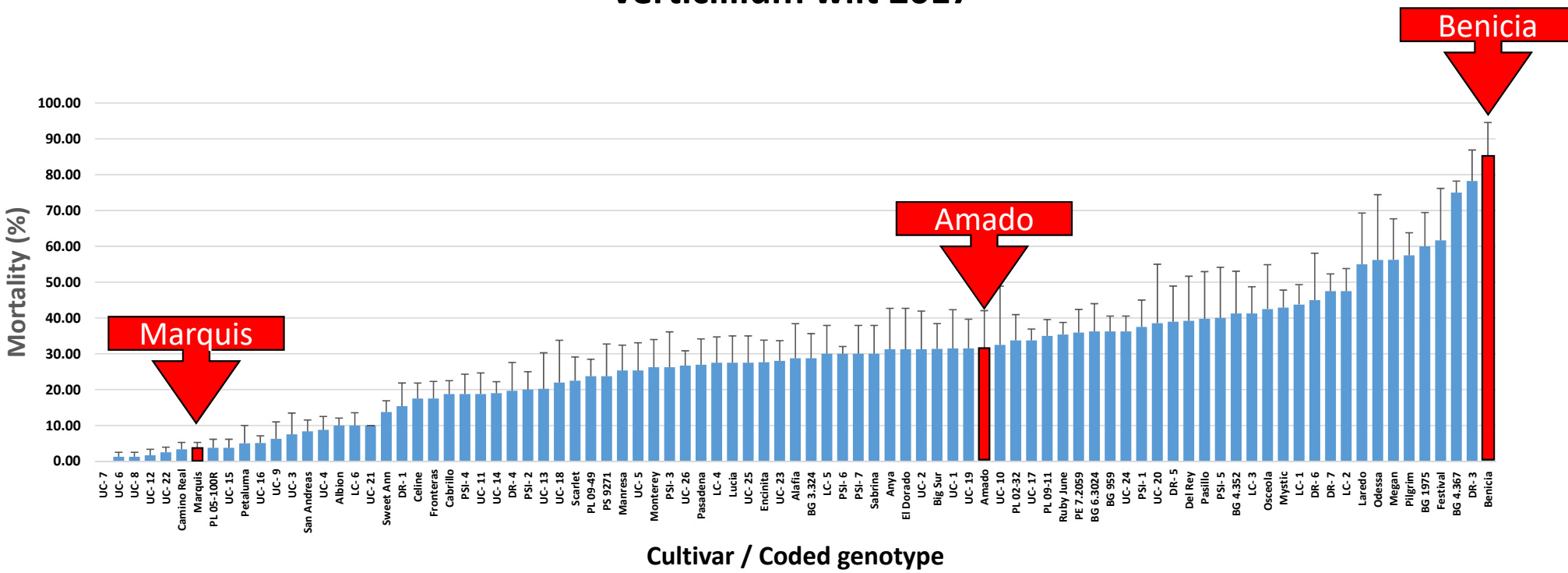
90 genotypes
30 cultivars
60 elite lines
4 replicates
14 DAP

- ✓ **Reading plant mortality every two weeks**
- ✓ **Drone imaging every two weeks after planting**

Verticillium wilt 2017



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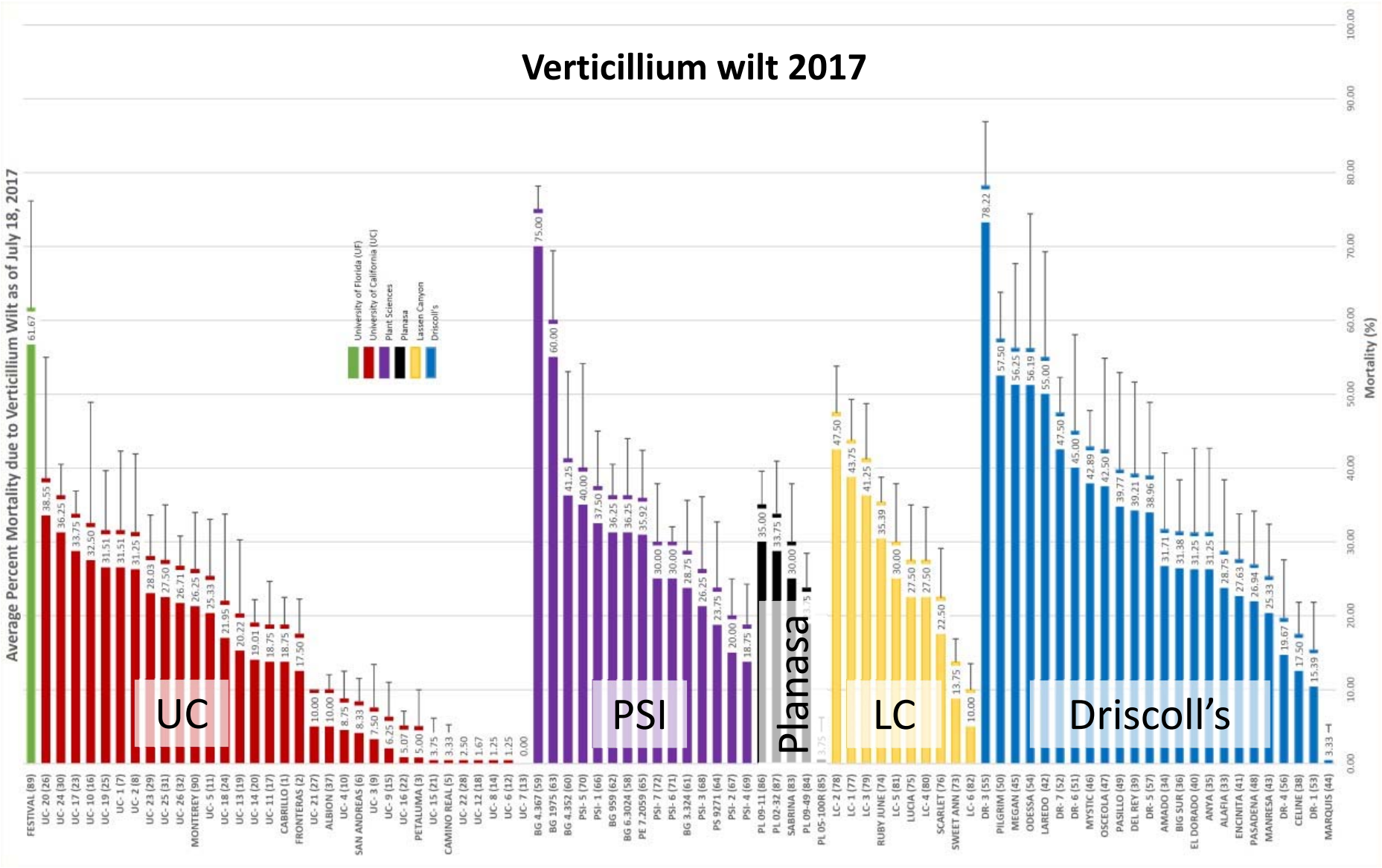
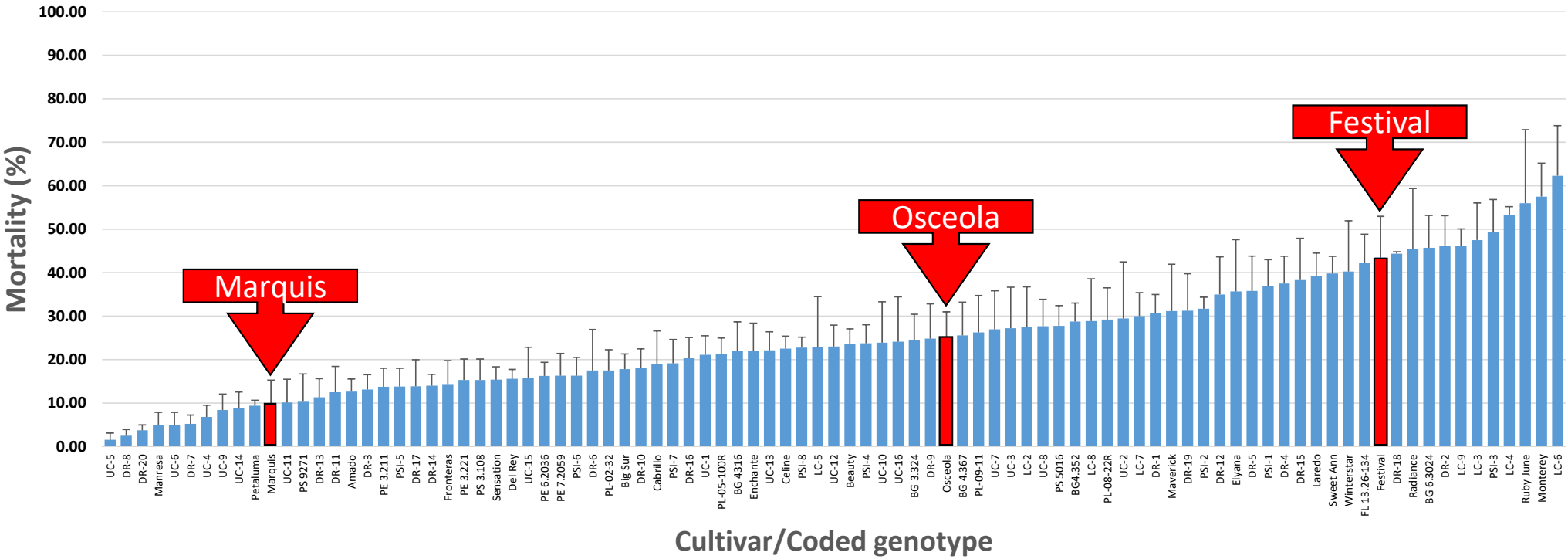
Verticillium wilt 2017



Verticillium wilt 2018



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Verticillium Field

Week
30

Week
43

VERTICILLIUM TRIAL

July 15, 2017

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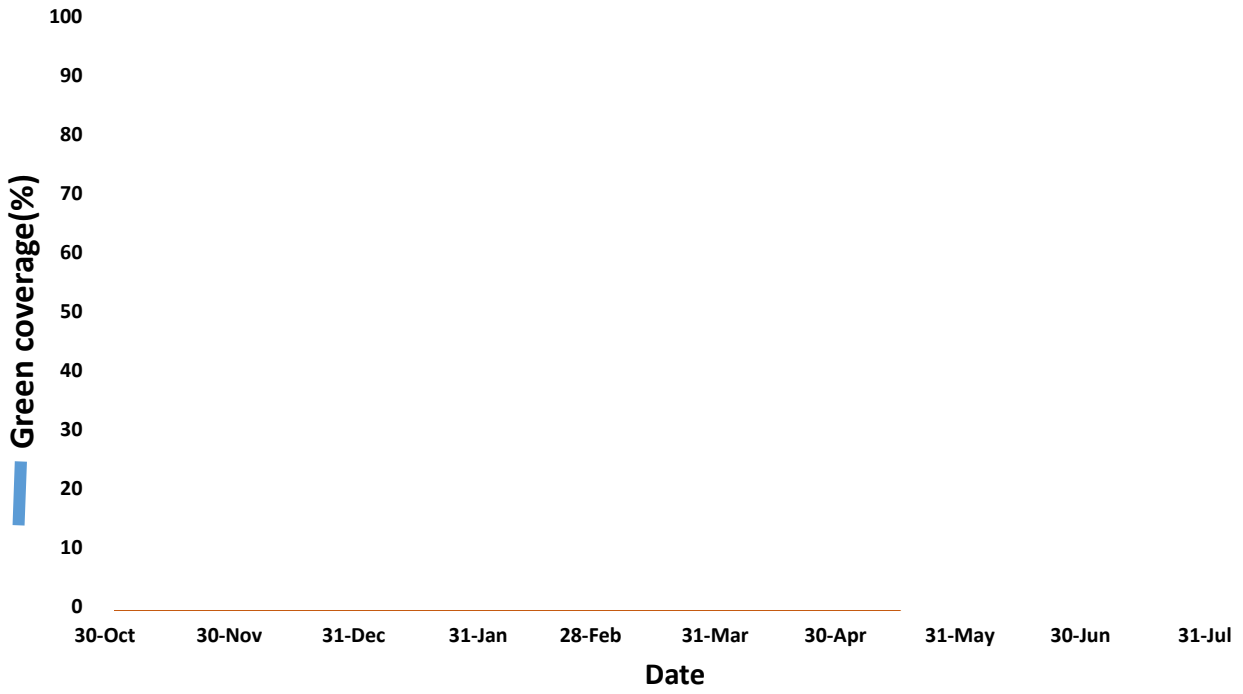
Monterey (Vert-S)



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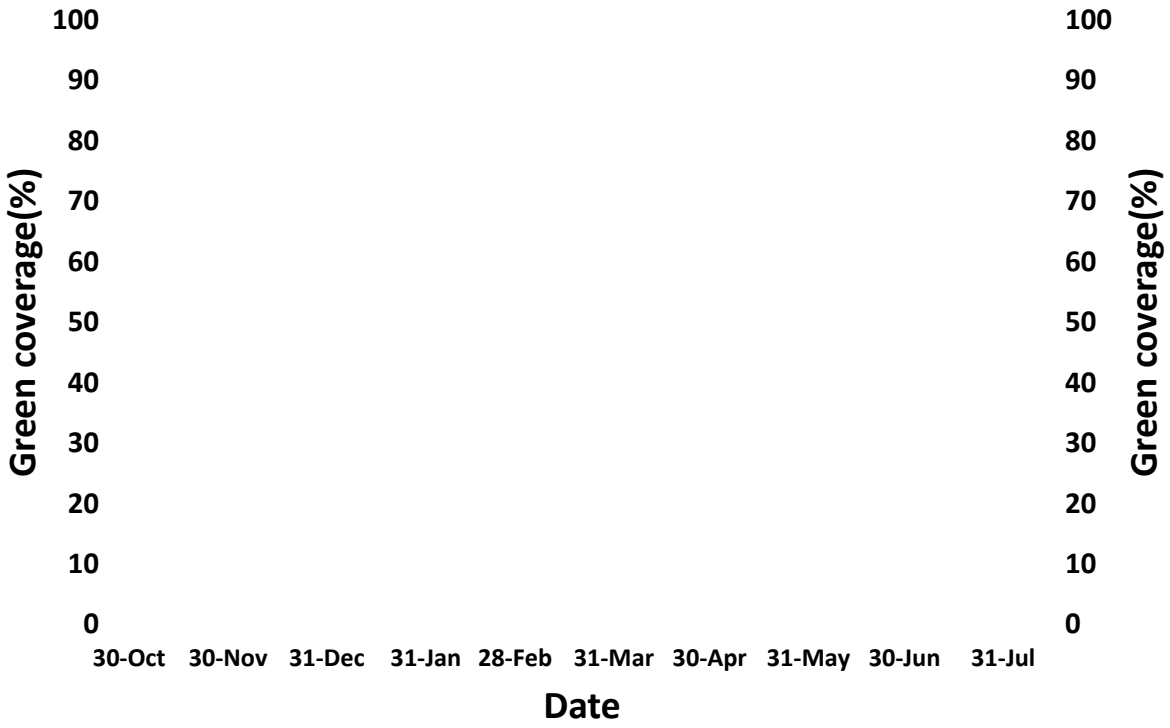
Manresa (Vert-R)



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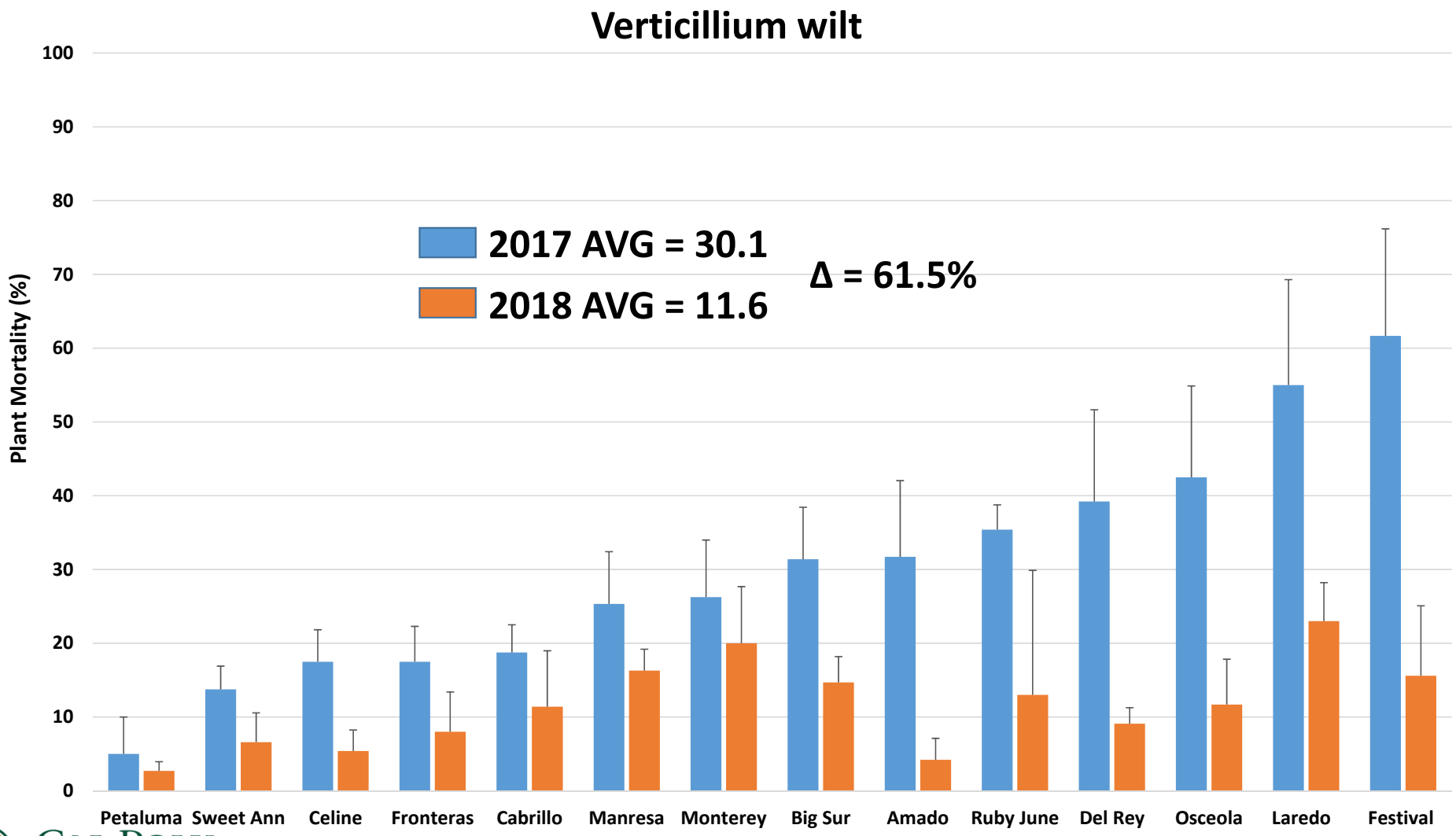

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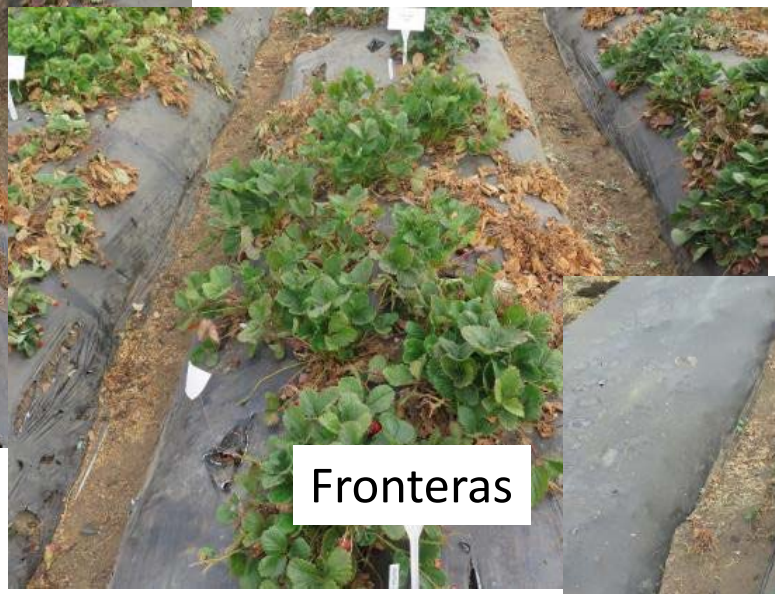
MACROPHOMINA TRIAL

14 DAP

March 1, 2017

MACROPHOMINA TRIAL

August 1, 2017



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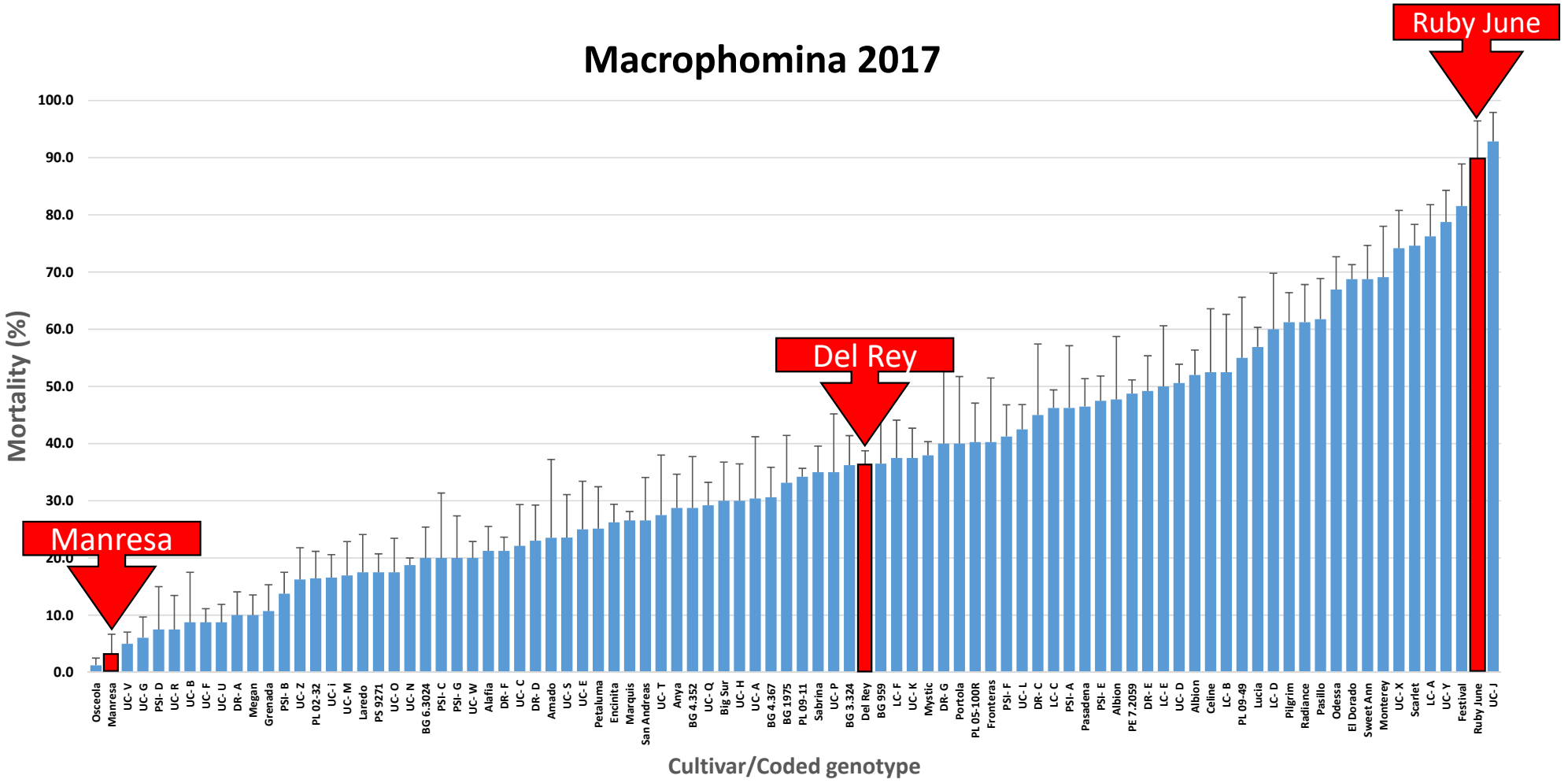

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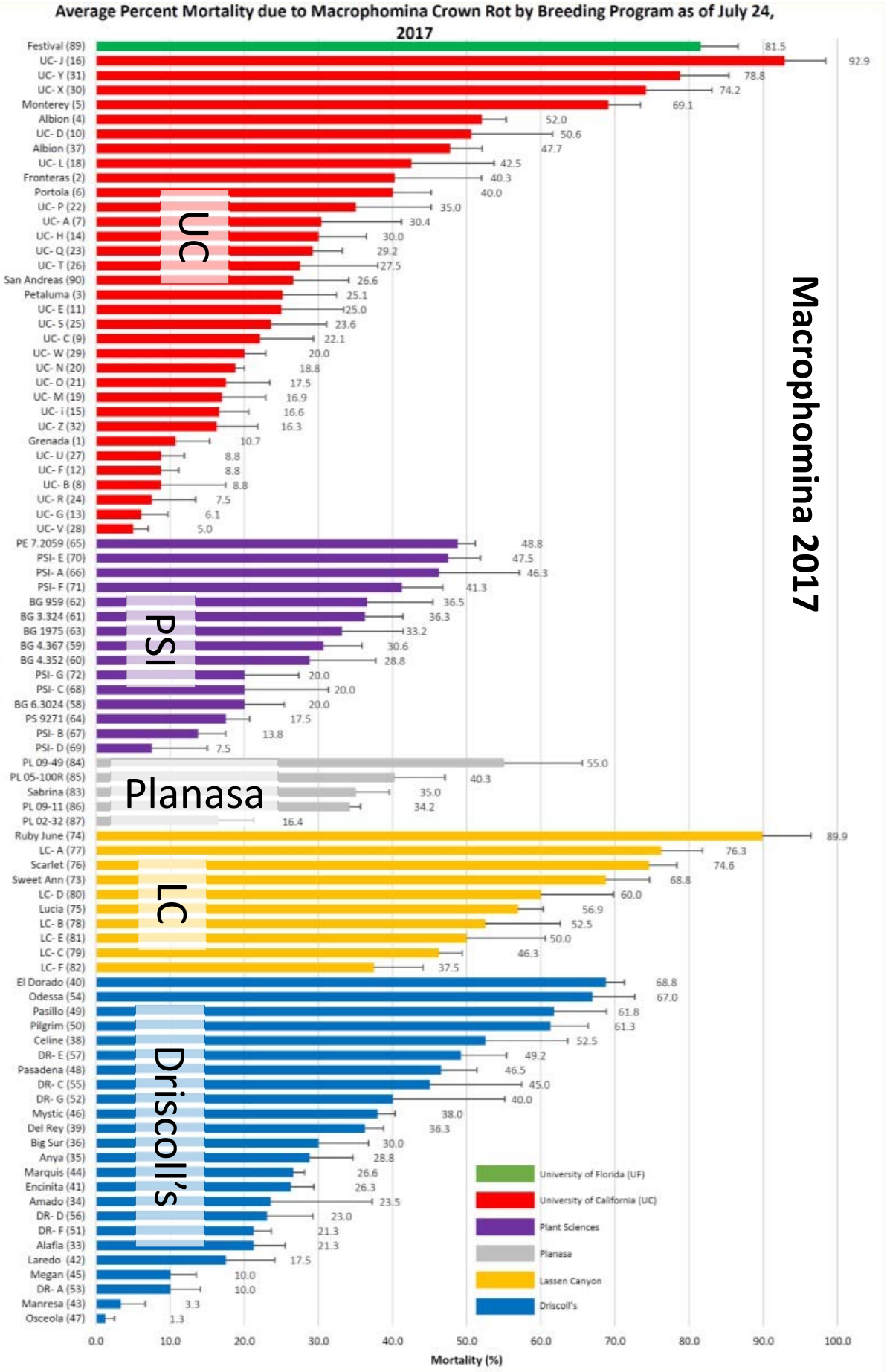
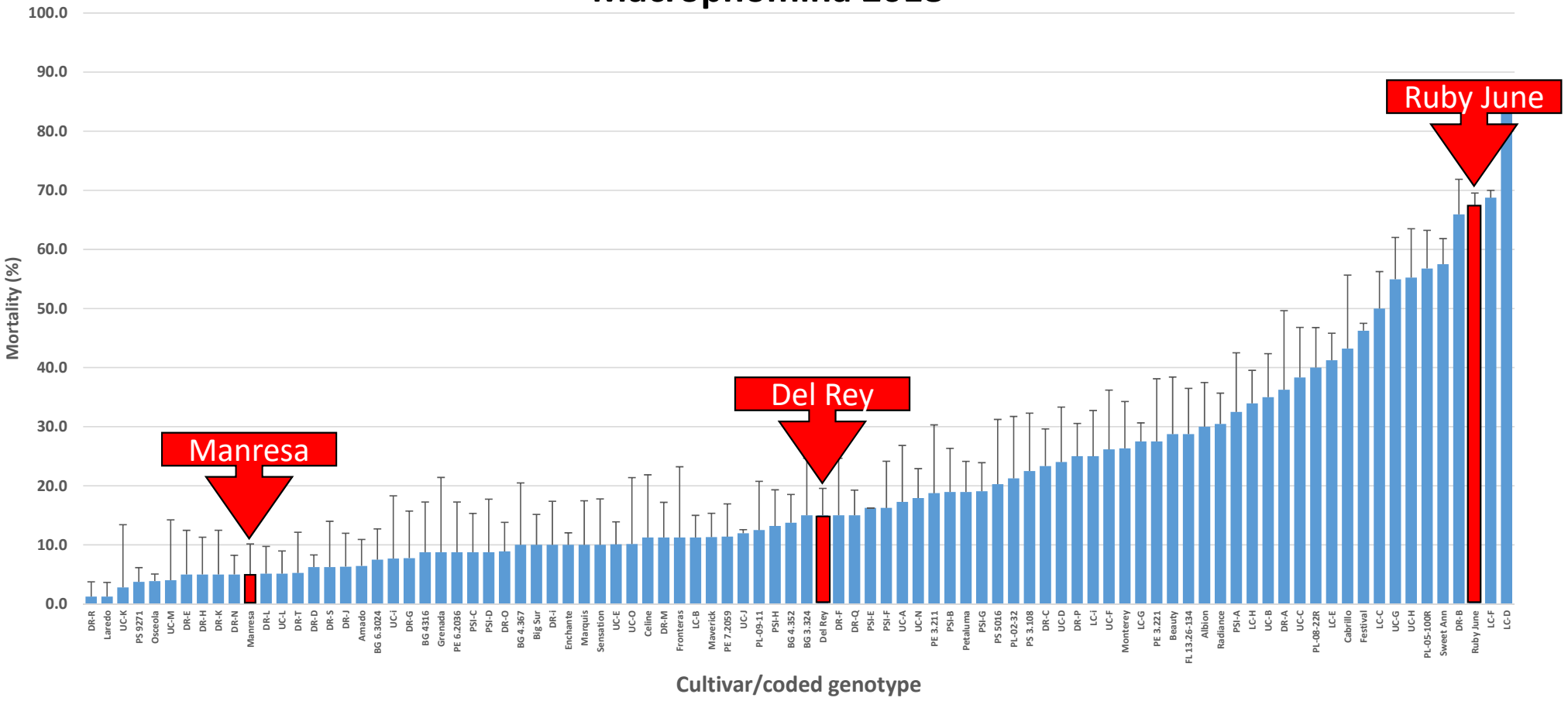

Average Percent Mortality due to Macrophomina Crown Rot by Breeding Program as of July 24, 2017
Festival (89) 81.5
UC- J (16) 92.9
UC- Y (31) 78.8
UC- X (30) 74.2
Monterey (5) 69.1
Albion (4) 52.0
UC- D (10) 50.6
Albion (37) 47.7
UC- L (18) 42.5
Fronteras (2) 40.3
Portola (6) 40.0
UC- P (22) 35.0
UC- A (7) 30.4
UC- H (14) 30.0
UC- Q (23) 29.2
UC- T (26) 27.5
San Andreas (90) 26.6
Petaluma (3) 25.1
UC- E (11) 25.0
UC- S (25) 23.6
UC- C (9) 22.1
UC- W (29) 20.0
UC- N (20) 18.8
UC- O (21) 17.5
UC- M (19) 16.9
UC- i (15) 16.6
UC- Z (32) 16.3
Grenada (1) 10.7
UC- U (27) 8.8
UC- F (12) 8.8
UC- B (8) 8.8
UC- R (24) 7.5
UC- G (13) 6.1
UC- V (28) 5.0
UC
PE 7.2059 (65) 48.8
PSI- E (70) 47.5
PSI- A (66) 46.3
PSI- F (71) 41.3
BG 959 (62) 36.5
BG 3.324 (61) 36.3
BG 1975 (63) 33.2
BG 4.367 (59) 30.6
BG 4.352 (60) 28.8
PSI- G (72) 20.0
PSI- C (68) 20.0
BG 6.3024 (58) 20.0
PS 9271 (64) 17.5
PSI- B (67) 13.8
PSI- D (69) 7.5
PSI
PL 09-49 (84) 55.0
PL 05-100R (85) 40.3
Sabrina (83) 35.0
PL 09-11 (86) 34.2
PL 02-32 (87) 16.4
Planasa
Ruby June (74) 89.9
LC- A (77) 76.3
Scarlet (76) 74.6
Sweet Ann (73) 68.8
LC- D (80) 60.0
Lucia (75) 56.9
LC- B (78) 52.5
LC- E (81) 50.0
LC- C (79) 46.3
LC- F (82) 37.5
LC
El Dorado (40) 68.8
Odessa (54) 67.0
Pasillo (49) 61.8
Pilgrim (50) 61.3
Celine (38) 52.5
DR- E (57) 49.2
Pasadena (48) 46.5
DR- C (55) 45.0
DR- G (52) 40.0
Mystic (46) 38.0
Del Rey (39) 36.3
Big Sur (36) 30.0
Anya (35) 28.8
Marquis (44) 26.6
Encinita (41) 26.3
Amado (34) 23.5
DR- D (56) 23.0
DR- F (51) 21.3
Alafia (33) 21.3
Laredo (42) 17.5
Megan (45) 10.0
DR- A (53) 10.0
Manresa (43) 3.3
Osceola (47) 1.3
Driscoll's
University of Florida (UF)
University of California (UC)
Plant Sciences
Planasa
Lassen Canyon
Driscoll's
0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0
Mortality (%)
Macrophomina 2017

Macrophomina 2018



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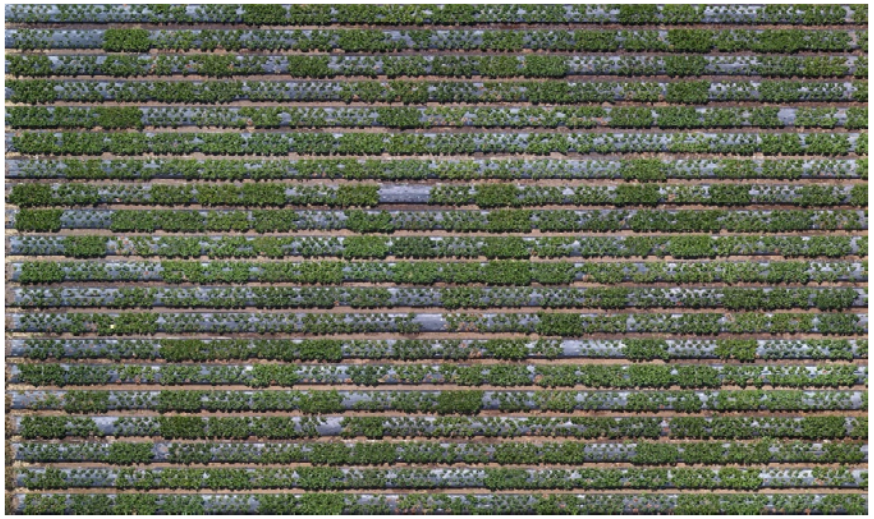
Verticillium Field

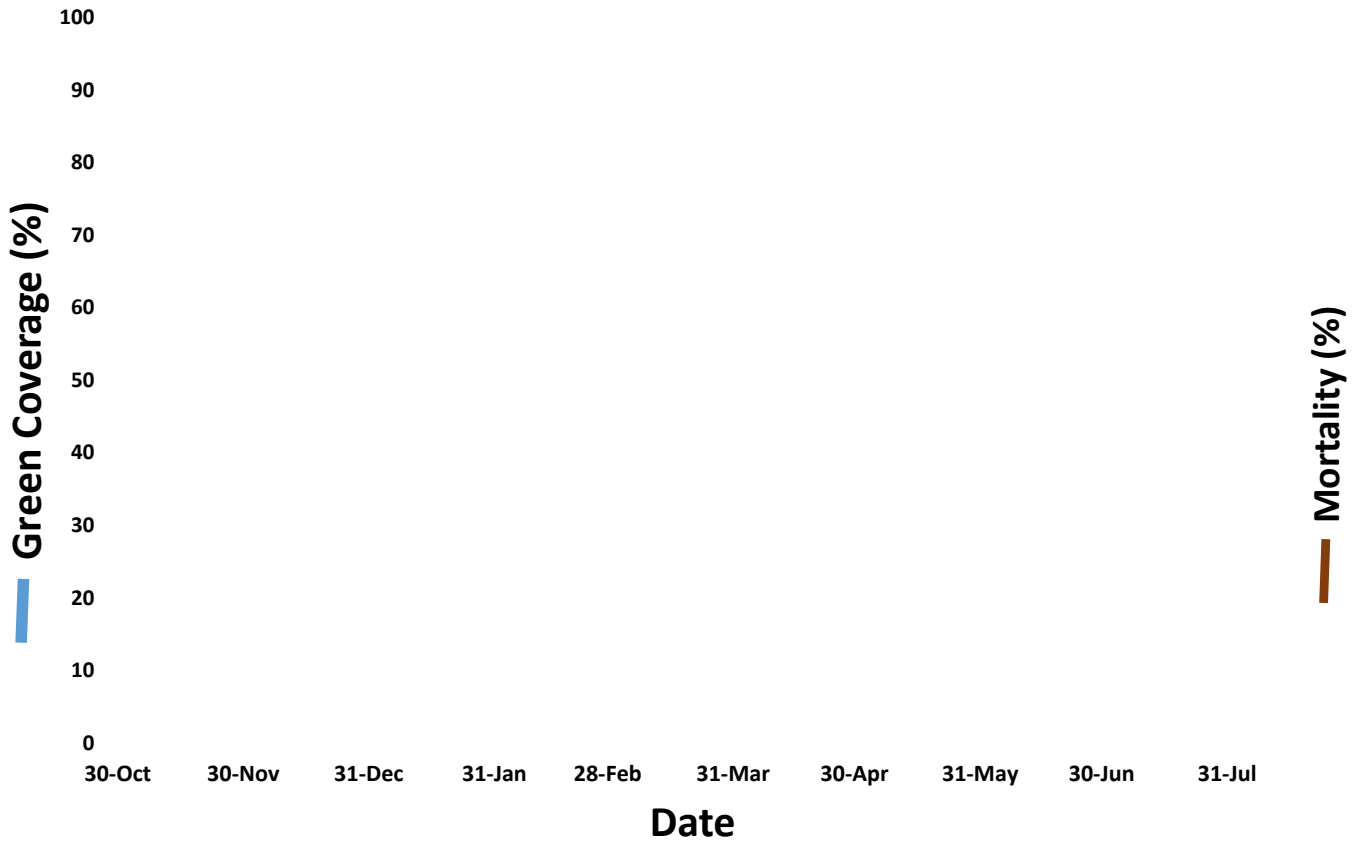
Week 30

Week 43

Macrophomina Field



Ruby June (Mac-S)



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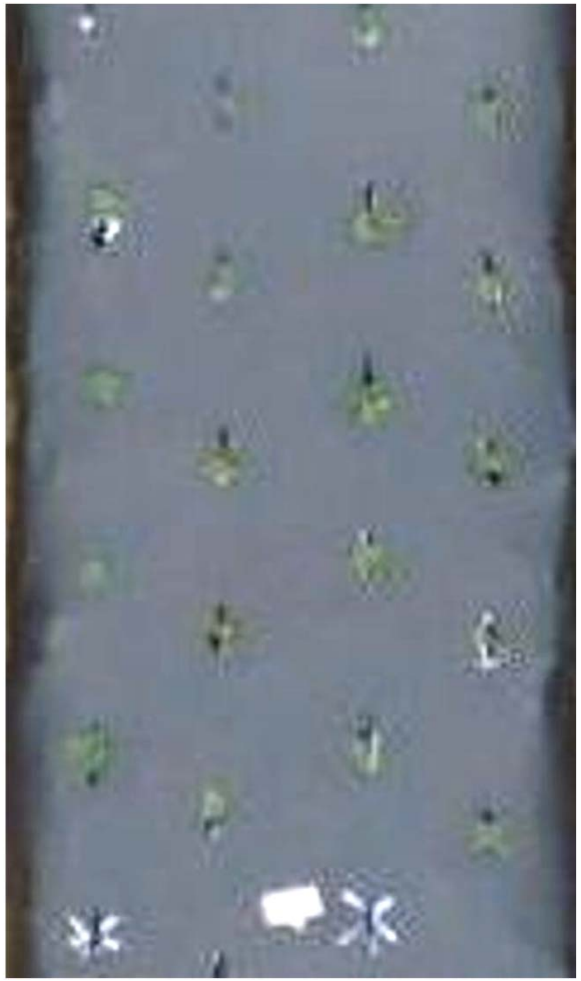
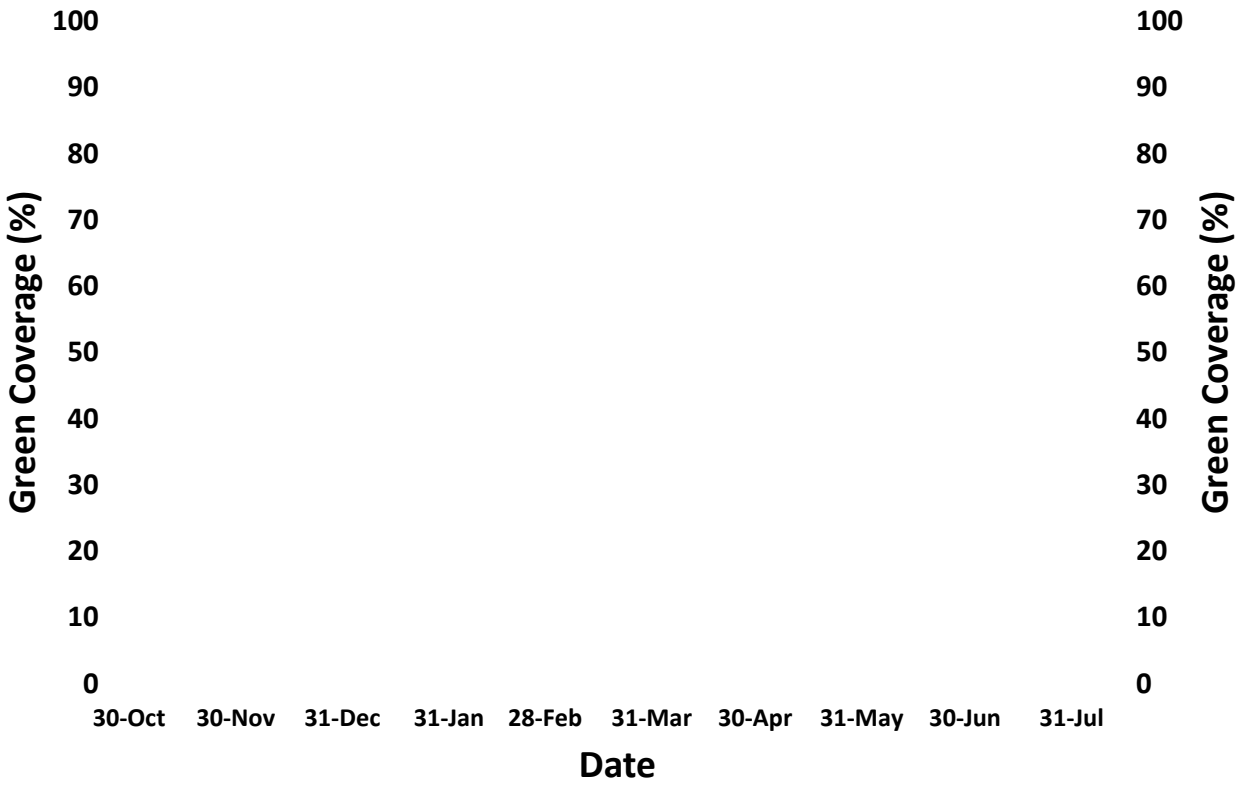


Osceola (Mac-R)



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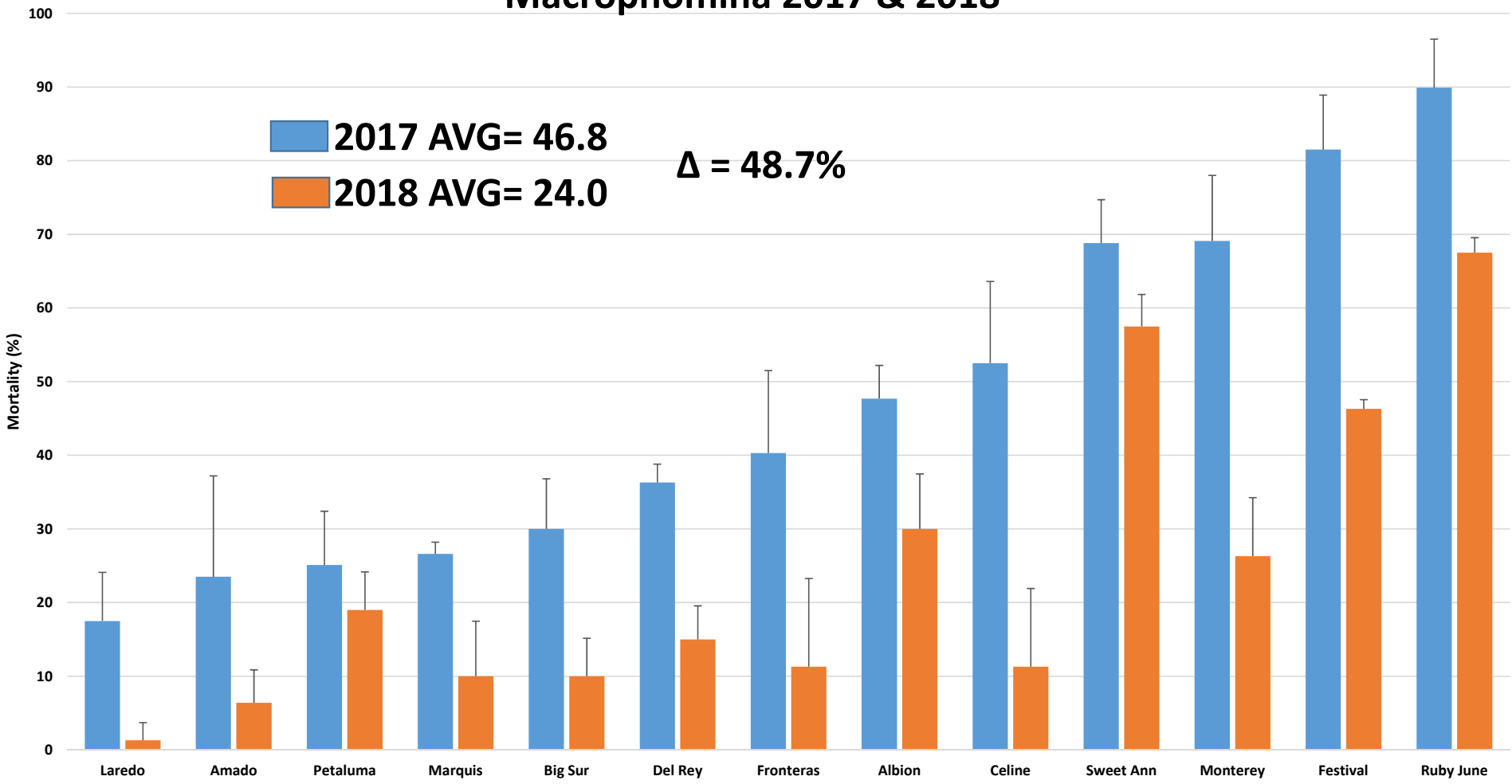
Macrophomina 2017 & 2018



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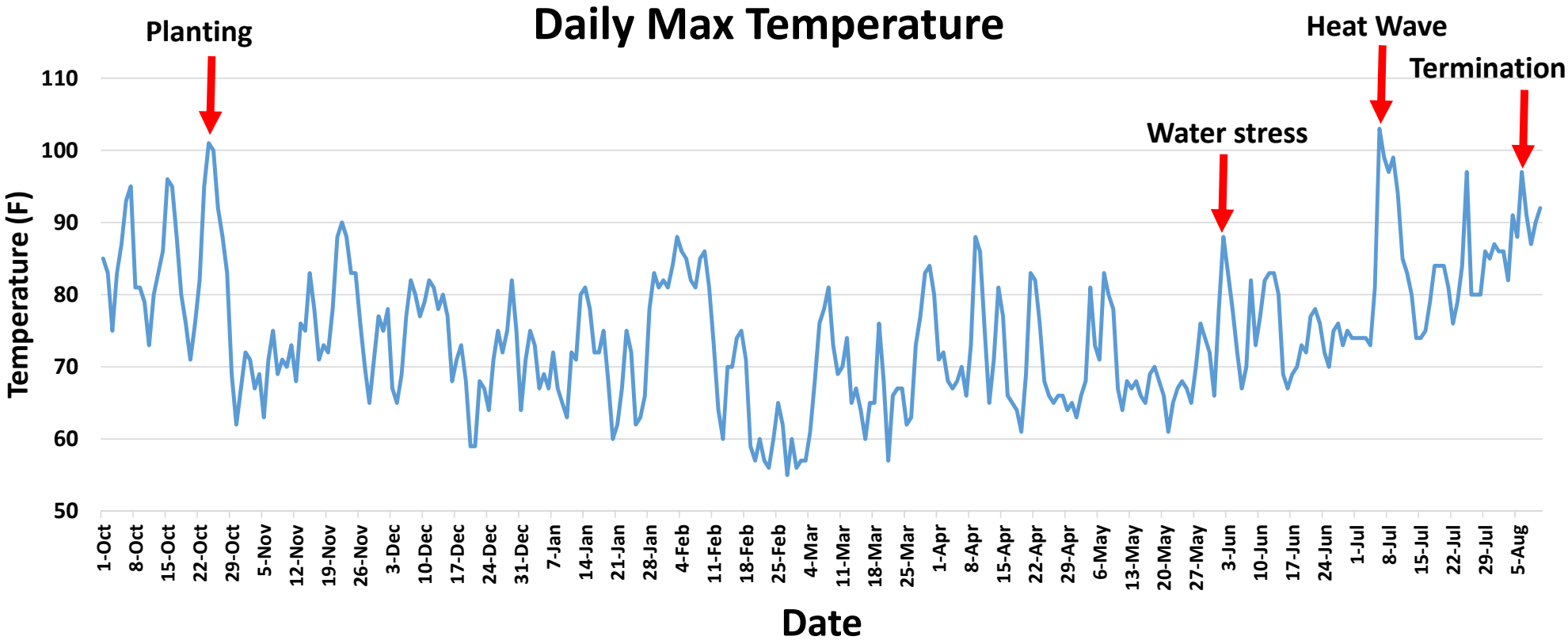

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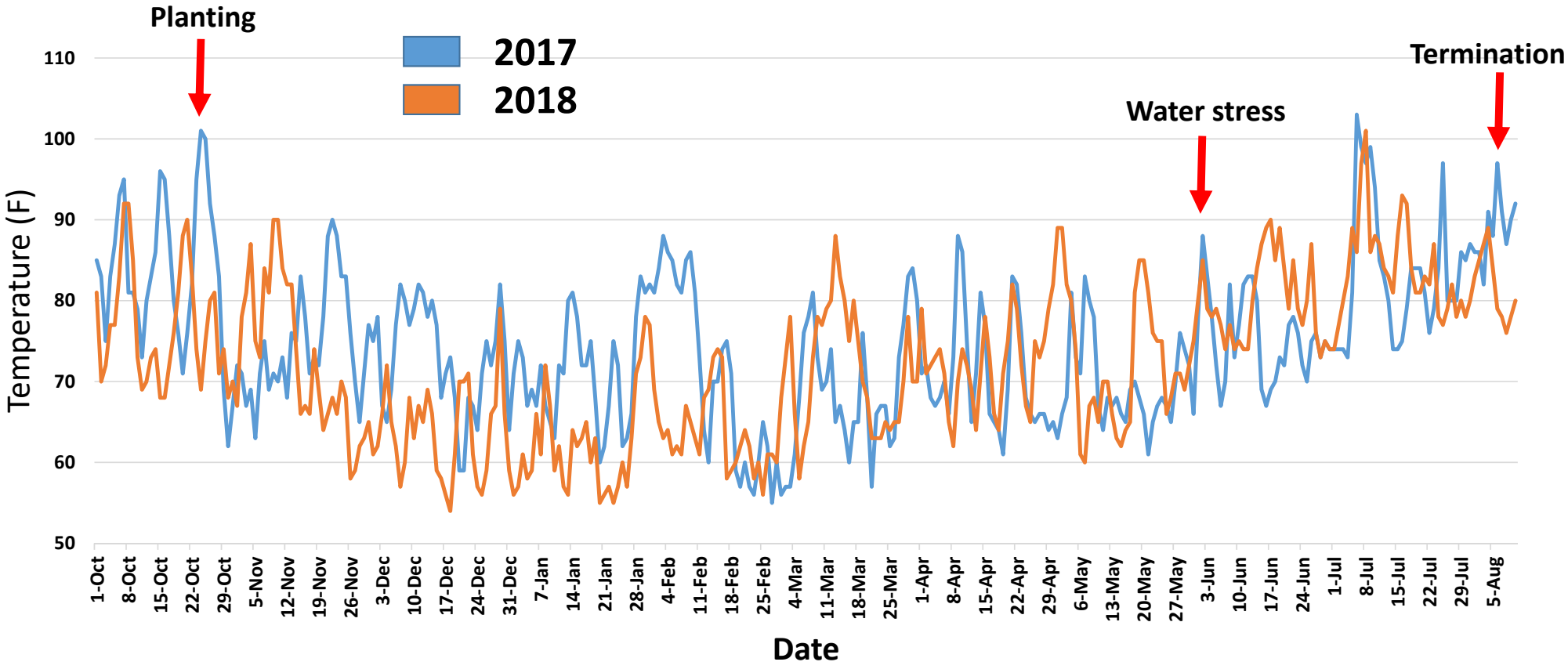
Daily Maximum Temperature



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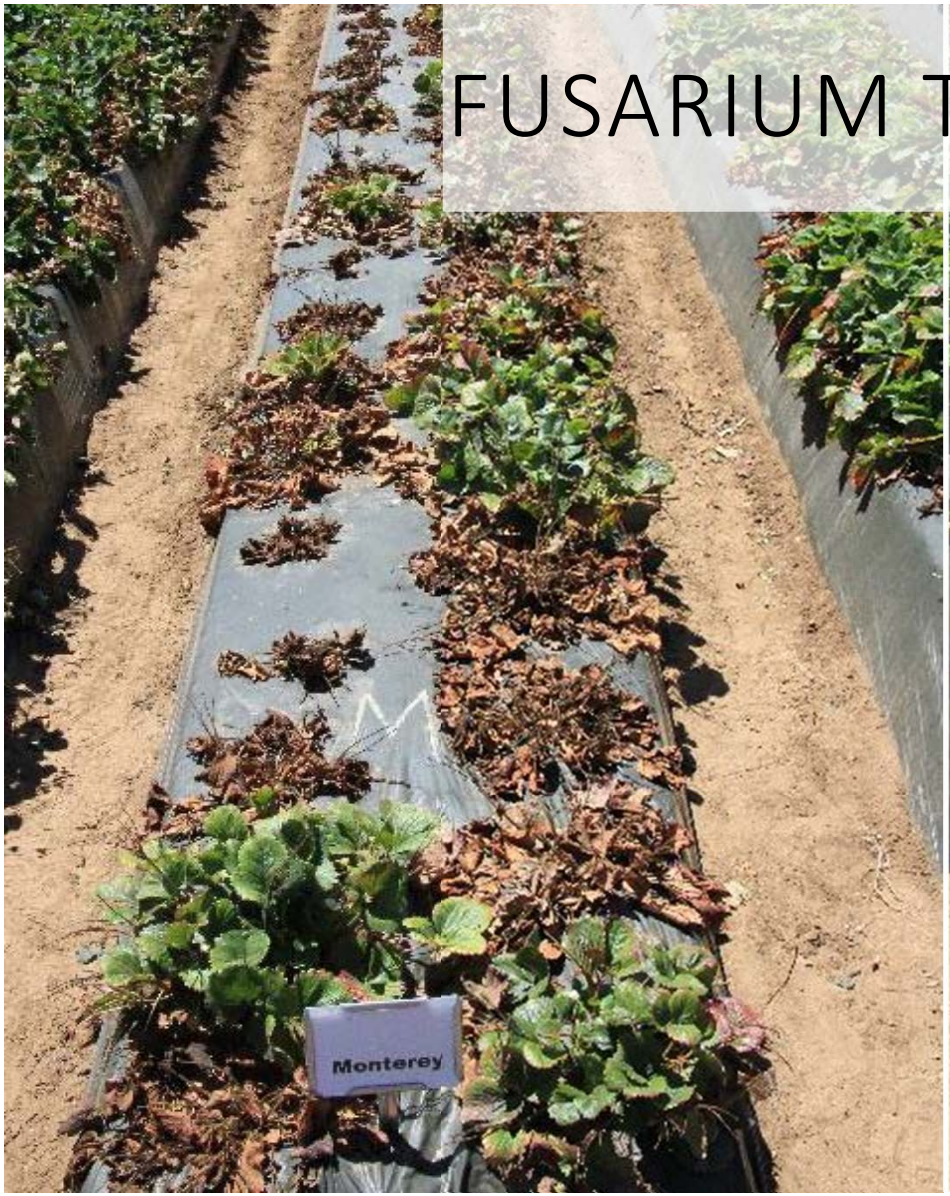
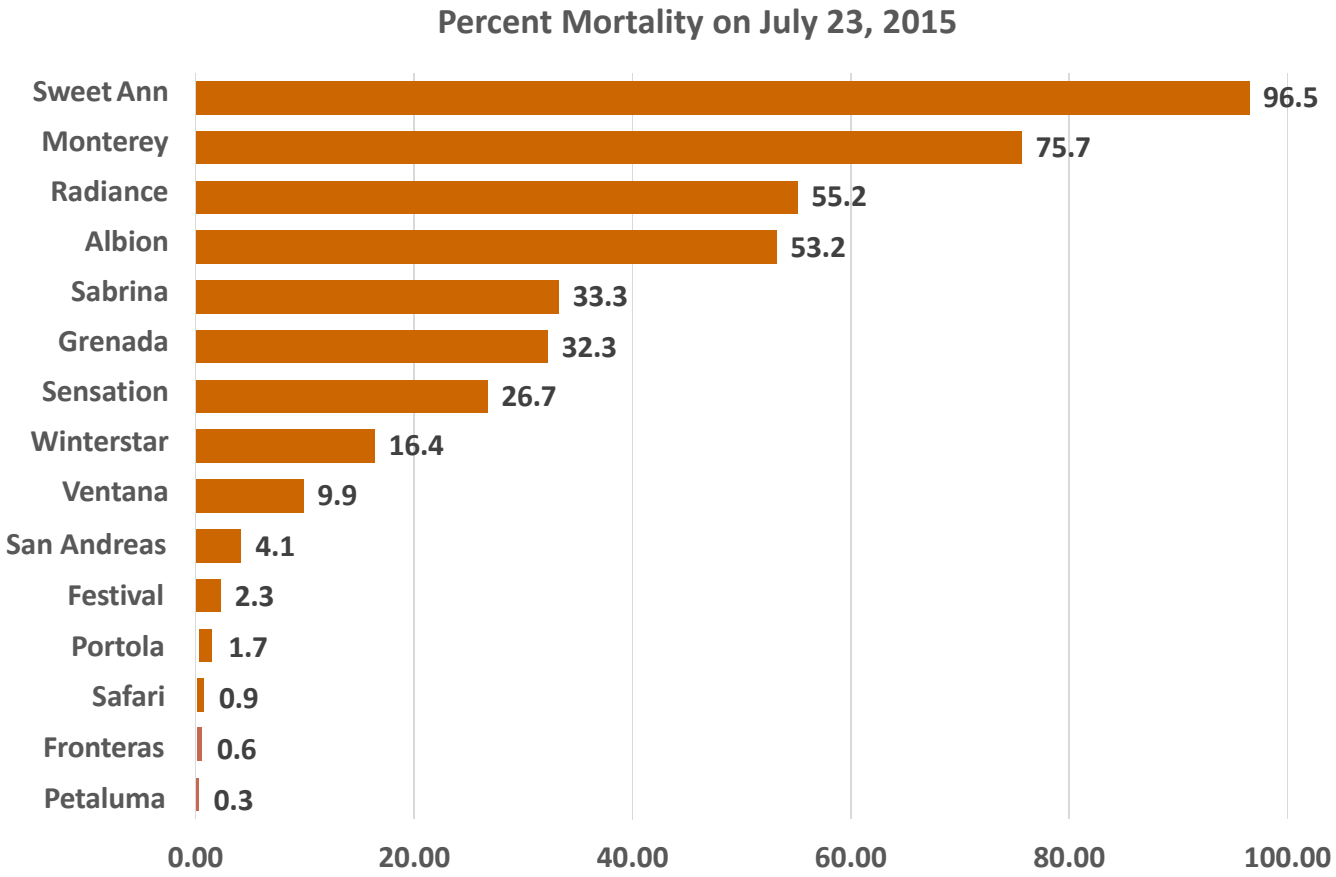
Monterey Bay Academy
Fusarium oxysporum f.sp. *fragariae*

FUSARIUM TRIAL 2015

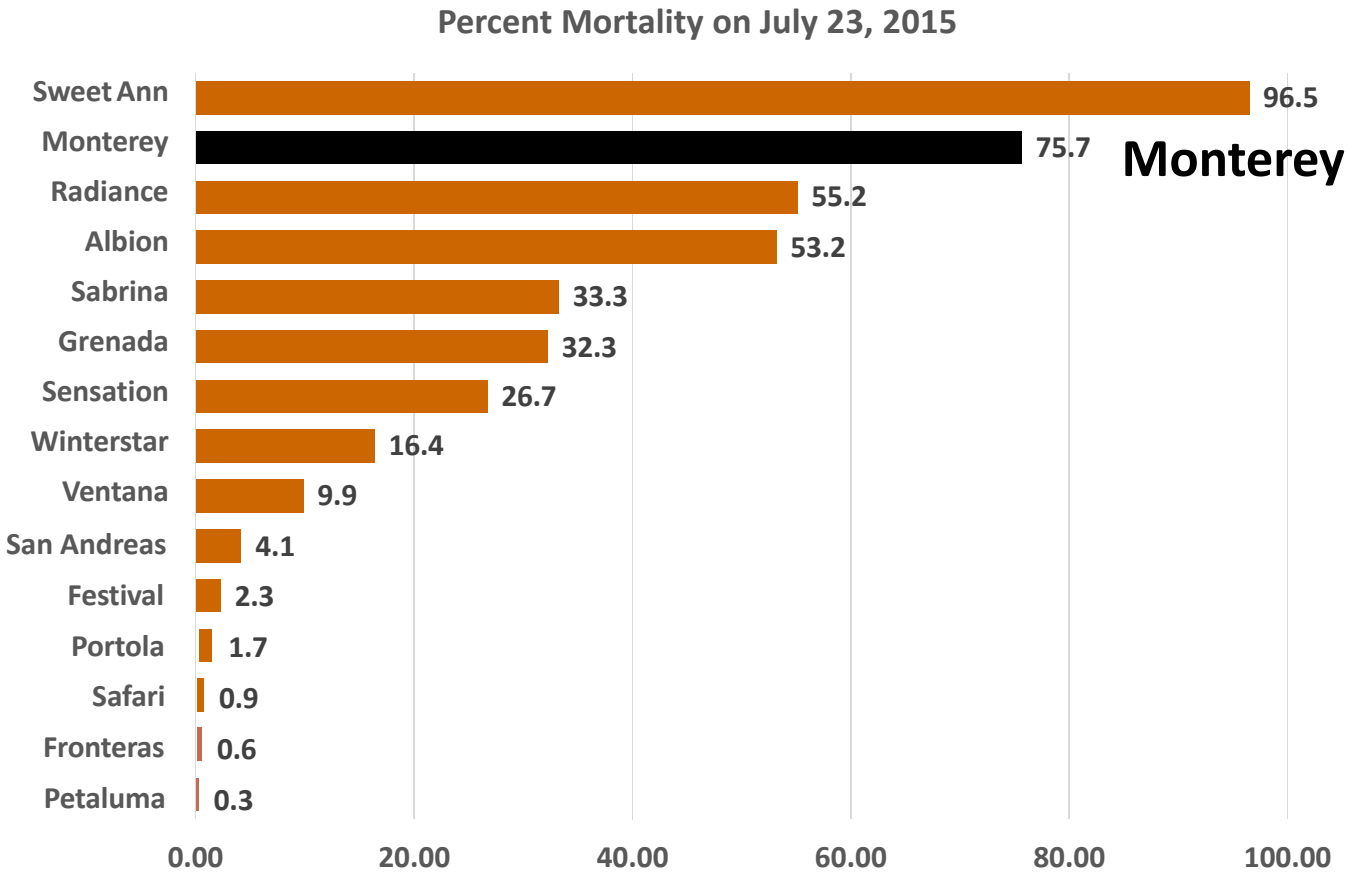
FUSARIUM TRIAL 2015



FUSARIUM TRIAL 2015

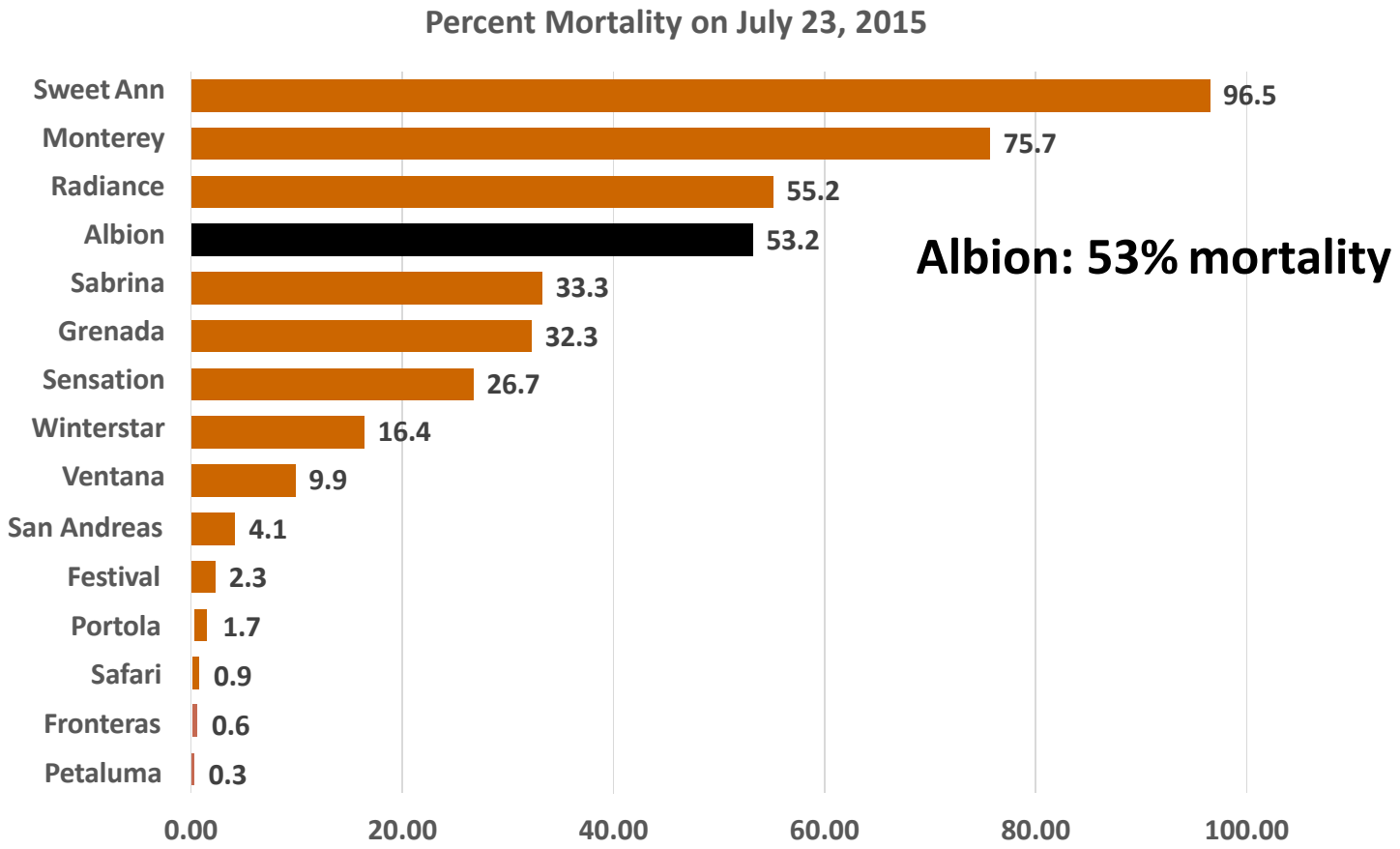


FUSARIUM TRIAL 2015



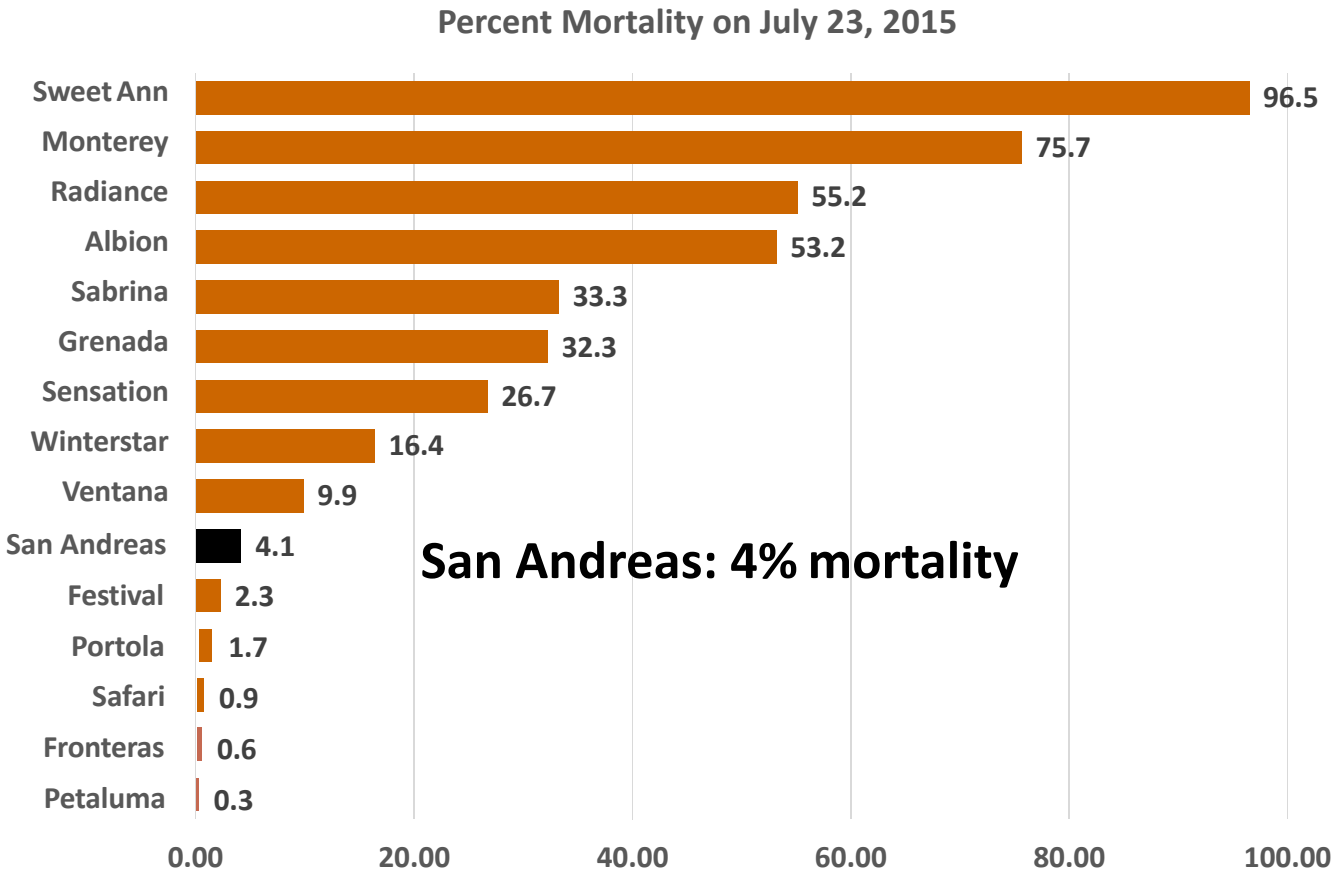
Monterey: 75% mortality

FUSARIUM TRIAL 2015

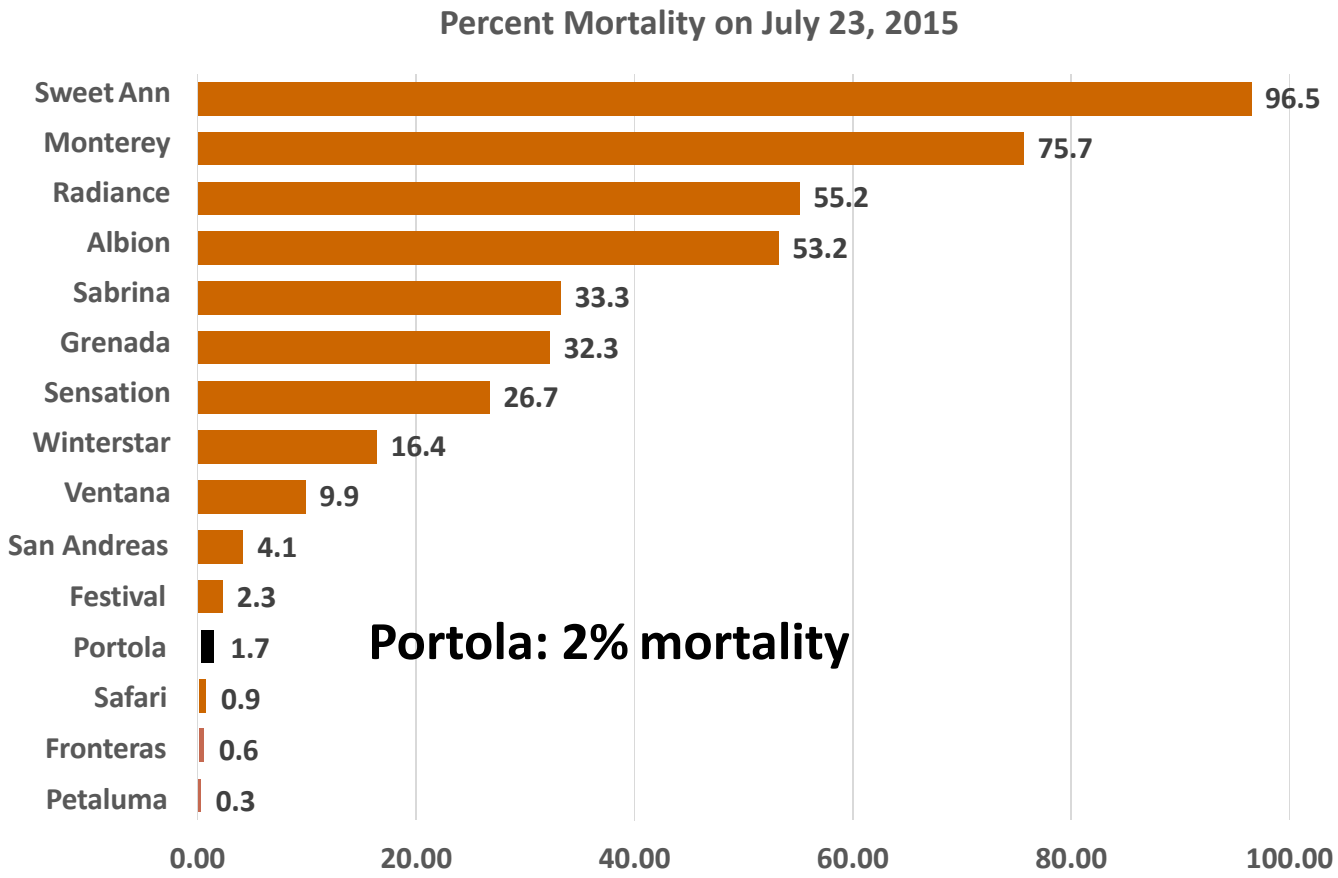


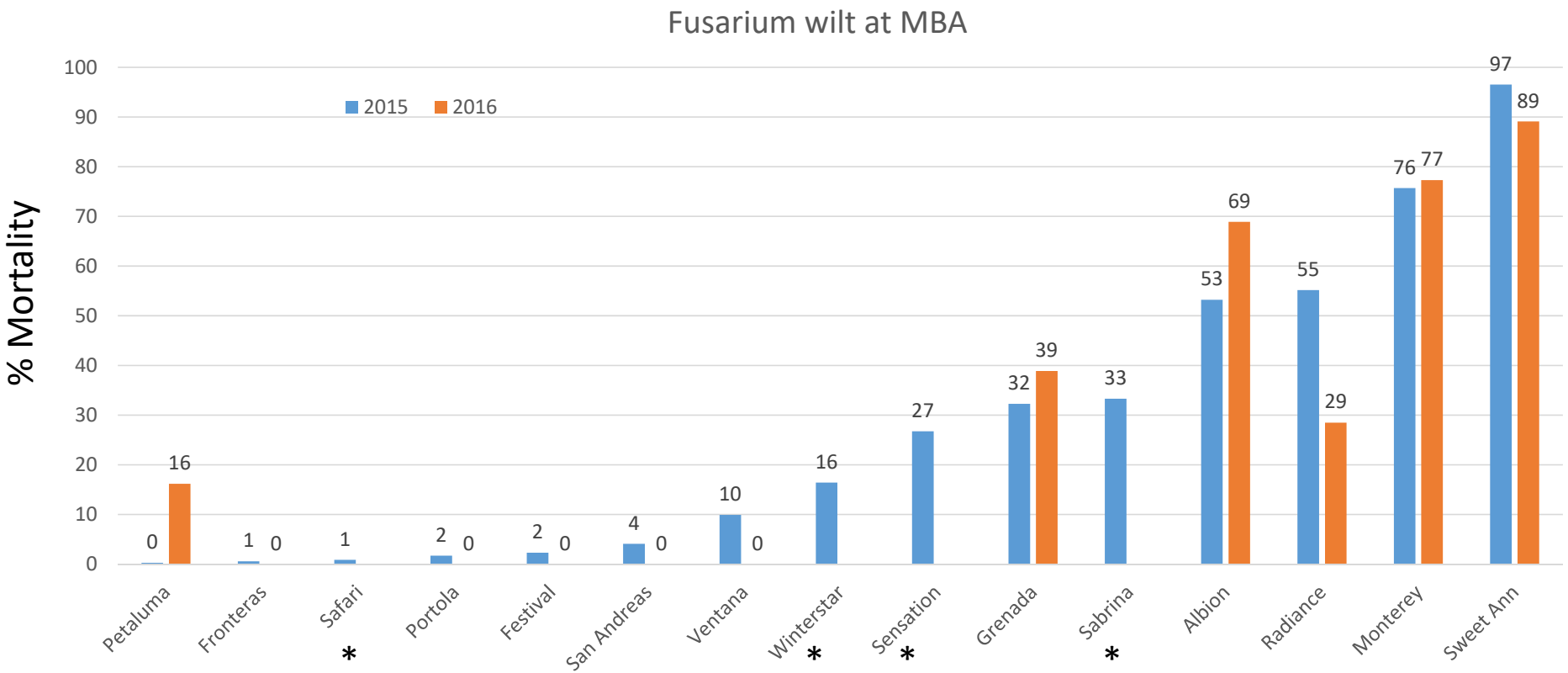
Albion: 53% mortality

FUSARIUM TRIAL 2015



FUSARIUM TRIAL 2015





* = not included in 2016 exp't

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DN or SD

- Day Neutral
- Short Day

Variety

- Select All
- 16DN009
- 16DN011
- 16DN012
- 16SD034
- 16SD045
- Albion
- Benicia
- Cabrillo
- Camarosa
- Camino Real
- Diamante
- Fronteras
- Gaviota
- Grenada
- Merced
- Mojave
- Monterey
- Palomar
- Petaluma
- Portola
- San Andreas
- Seascape
- Selva
- Ventana

Legend Acronym	Legend	Resistance Numerical Category
R	Resistant	1
MR	Moderate Resistance	2
MS	Moderate Susceptibilty	3
S	Susceptible	4

Variety	Type	Macrophomina	Verticillium	Fusarium	Phytophthora
16SD034	SD	2	3	1	2
16SD045	SD	3	3	1	2
Portola	DN	4	2	1	2
16DN012	DN	4	2	1	3
Camino Real	SD	4	1	3	2
Diamante	DN	3	3	1	3
Fronteras	SD	3	3	1	3
San Andreas	DN	4	2	1	3
Grenada	SD	2	2	4	3
Petaluma	SD	3	2	3	3
Ventana	SD	4	3	1	3
16DN009	DN	3	2	4	3
Palomar	SD	3	3	3	3
Selva	DN	3	2	4	3
16DN011	DN	4	2	4	3
Albion	DN	4	2	4	3
Cabrillo	DN	4	2	4	3
Merced	SD	4	3	4	2
Gaviota	SD	4	3	4	3
Mojave	SD	4	3	4	3
Monterey	DN	4	3	4	3
Benicia	SD	4	4	4	3
Camarosa	SD	4	4	4	3
Seascape	DN	4	4	4	3

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Conclusions

- Wide range of susceptibility among genotypes and breeding program entries
- High levels of resistance to Verticillium wilt, Fusarium wilt and Macrophomina crown rot
- Results consistent between years
- Aerial images were equally effective to ground ratings

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Acknowledgements

SCRI grant No. 2017-51181-26833


Hold the date:
Field Day
July 18, 2019

CALIFORNIA STRAWBERRY COMMISSION

We are pleased to announce the second

California Strawberry Automation Sur

April 3, 2019
8:00 a.m. - 5:00 p.m.

Performing Arts Center
Cal Poly San Luis Obispo