Fusarium wilt experience: varietal differences & observations

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Fresno Tomato Meeting 16 Dec 2014

Verticillium wilt

Verticillium dahliae

photo: UC Statewide IPM Project

Fusarium wilt, race 3

Symptoms of Fusarium wilt of tomato

- ✓ Yellowing of branches and leaves
- ✓ Vascular discoloration
- ✓ General wilting often leading to necrosis/death

Fusarium wilt

Fusarium oxysporum f. sp. *lycopersici*

Fusarium Wilt Race 3

Australia 1978
Florida 1982
California 1987
Mexico 1996

Fusarium wilt race 3

Sutter Co.
Colusa Co.
Yolo Co.
Sacramento Co.
Solano Co.
San Joaquin Co.


Fusarium wilt, race 3

		9-Jul	
		Fusarium infected	% Fusarium infected
	treatment	# plants/plot	
1	control	42	52
2	Caliente 119C mustard	57	70
	LSD 5%	4	
	% CV	7	


FUSARIUM WILT

Varietal susceptibility to Fusarium wilt, race 3,

Woodland, 2013

	Variety		30-Aug Yield tons/A		19-Jul ~% Fusarium wilt	28-Aug % canopy necrosis	% sun burn	% rots
1	N 6407	VFFNPtsw	55.1	a	16	69	8	4
2	SV 0335	VFF**F3**NPsw	54.8	ab	2	10	2	9
3	CXD 282	VFF**F3**NP	54.6	ab	0	10	2	6
4	AB 311	VFFNPtsw	51.5	abc	13	46	2	6
5	H 2401	VFFNP	48.3	bcd	7	57	5	4
6	DRI 319	VFFNPsw	48.0	cd	13	60	5	10
7	AB 2	VFFP	46.5	cd	8	39	4	5
8	H 1175	VFFN	46.0	cd	27	64	12	2
9	H 5608	VFFNPsw	45.5	cd	22	60	8	4
10	H 8504	VFFNP	45.0	cd	18	68	12	3
11	HM 1892	VFFNP	42.2	de	23	76	11	6
12	N 6366	VFFNP	38.0	e	30	89	17	8
13	BQ 268	VFFNP	30.6	f	23	89	17	6
14	N 6404	VFFNPsw	25.1	f	35	91	29	6
15	HM 7883	VFFNP	16.5	g	37	98	40	6
	LSD 0.05		6.5		11	21	9.1	NS
	CV		11		41	24	55	54

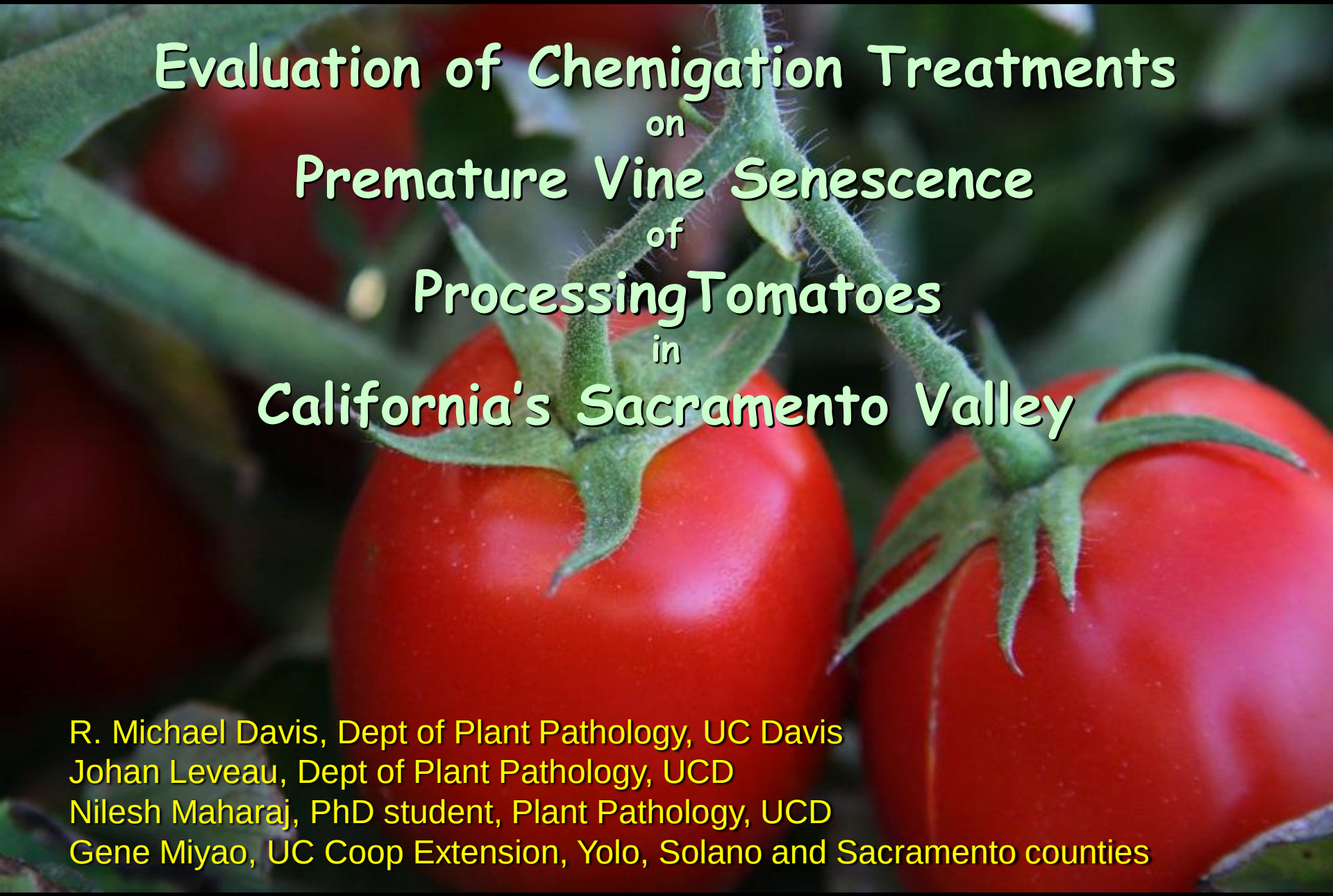
- Resistance works well
- Yield outcome influenced by other factors

2007 variety field test, Elkhorn: 11 days before harvest

2007 variety field test, Elkhorn: 1 day before harvest

2007 variety field test, Elkhorn: 1 day before harvest

	Variety		3-Jul # Infected	19-Aug # Infected	Yield tons/A	
1	CXD 242	VFFF3NP	0	0	50.3	a
2	AB 2	VFFP	6	55	48.3	ab
3	CXD 221	VFFF3NP	0	0	48.2	ab
4	HMX 4798	VFFF3NP	0	0	48.1	ab
5	PS 438	VFFF3P	0	0	42.9	abc
6	CXD 246	VFFF3NP	0	1	42.8	abc
7	Heinz 9663	VFFNP	19	54	40.7	bc
8	HMX 5883	VFFF3NP	1	2	36.2	c
9	HMX 4802	~~VFFF3NP~~	15	48	35.2	c
	LSD 5%		4.7	13.9	8.3	
	% CV		71	54	13	



Evaluation of Chemigation Treatments on Premature Vine Senescence of ProcessingTomatoes in California's Sacramento Valley

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Premature vine scenescence

66 days before harvest

18 days before harvest

8 days before harvest

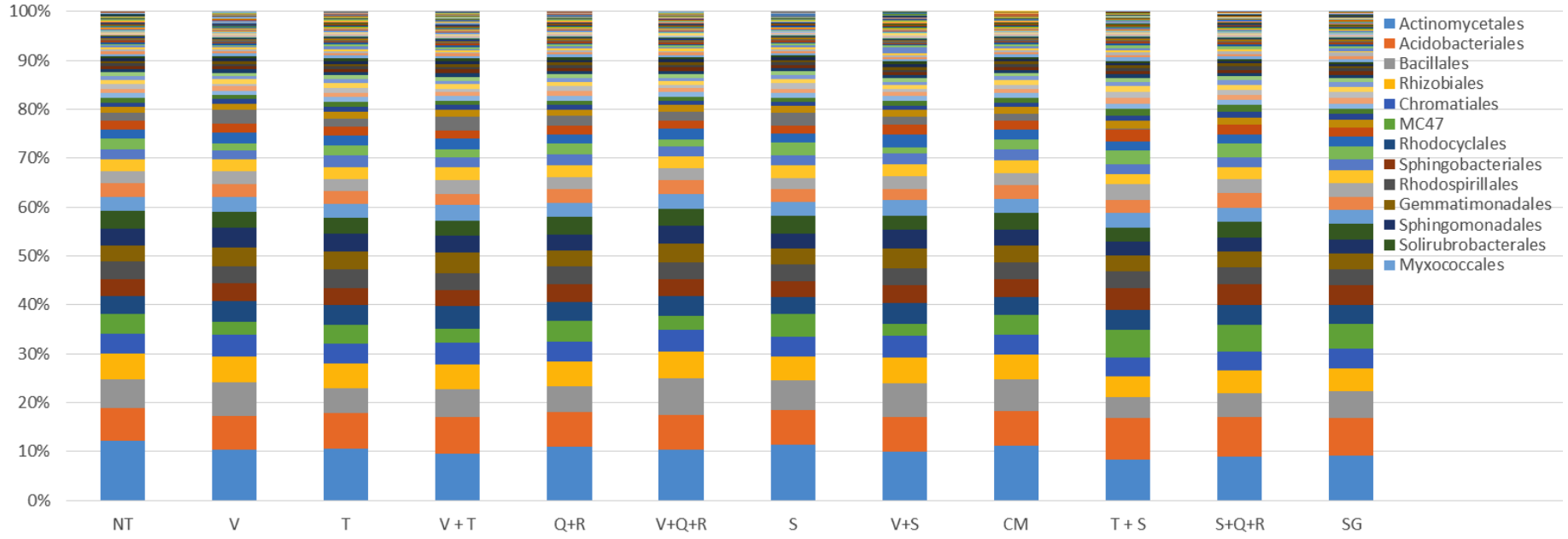
manufacturer	material	active ingredient	product rate/A	# applications	year	yield (% of control)	conditions	
Agrinos	HYT A	mixture of soil microbes	0.25 gpa	4	2014	103	Vert & F. wilt	Muller
CA Safe Soils	H2H	digested food waste	15 gpa pre shank fb 10 gpa	1 pre & 4 post	2014	100	Vert & F. wilt	Muller
PureAg	Simple Soil Solutions	various mycorrhizae and Bacillus species	1 gal volume per 100 acres (20 g/acre)	1 pre & 5 post	2014	98	Vert & F. wilt	Muller
LH Organics	Soil System 1	various mycorrhizae and Bacillus species	1 gal volume per 100 acres (25 g/acre)	root dip plus 10 apps	2013	104	Fusarium sola	Beeman
JH BioTech	Promot		0.5 gpa	root dip plus 5 apps	2013	104	Fusarium sola	Beeman
Converted Organics	LC 1-1-1	composted food waste		5	2013	103	Fusarium sola	Beeman
LH Organics	Soil System 1	various mycorrhizae and Bacillus species	1 gal volume per 100 acres (25 g/acre)	10	2013	101	Vert	Meek
JH BioTech	Promot		0.5 gpa	5	2013	101	Vert	Meek
Marrone Bio Innovations	Regalia	Extract of Reynoutria sachalinensis	1 gpa	6	2013	102	Vert	Meek
AgraQuest								
Bayer	Serenade Soil	*Bacillus subtilis*	1.5 gpa	5	2012	101	Vert	Payne
Bayer AgraQuest	Vapam f.b. Serenade Soil	*Bacillus subtilis*	1.5 gpa	5	2012	105	Vert	Payne
Natural Industries	Actinovate	*Streptomyces lydicus*	12 oz f.b. 6 oz thereafter	5	2012	96	Vert	Payne
AgraQuest							Vert &	
Bayer	Serenade Soil	*Bacillus subtilis*	1.5 gpa	4	2012	96	Fusarium wilt	Harlan #5
Bayer AgraQuest	Vapam f.b. Serenade Soil	*Bacillus subtilis*	1.5 gpa	4	2012	90	Vert & Fusarium wilt	Harlan #5
Agrinos	HYT A & HYT B	mixture of soil microbes	2.5 & 2 liter/acre	2	2012	94	average of 4 treatments	Button & Turkovich
Gowan	Tenet	*Trichoderma sp.*	2.5 lbs	4	2011	99	FORL & vert	Meek
Gowan	Vapam fb Tenet	*Trichoderma sp.*	2.5 lbs	4	2011	100	FORL & vert	Meek
Bayer AgraQuest	Serenade Soil	*Bacillus subtilis*	1.5 gpa	4	2011	110	FORL & vert	Meek
Bayer AgraQuest	Vapam fg Serenade Soil	*Bacillus subtilis*	1.5 gpa	4	2011	105	FORL & vert	Meek
Gowan	Tenet	*Trichoderma sp.*	2.5 lbs	4	2011	104	Vert & corky root	Timothy
Bayer AgraQuest	Serenade Soil		1.5 gpa	4	2011	97	Vert & corky root	Timothy
Gowan & AgraQuest	Tenet & Serenade Soil	*Trichoderma* sp. plus Bacillus subtilis	2.5 & 1.5 gpa, respectively	4	2011	99	Vert & corky root	Timothy
Bayer AgraQuest	Serenade Soil & Quadris	*Bacillus subtilis*	1.5 gpa	4	2011	100	Vert & corky root	Timothy
Certis, USA	SoilGard	*Gliocladium virens*	5 lbs/A	4	2011	94	Vert & corky root	Timothy

2012 Treatments

Control
Quadris + Ridomil
Vapam highest rate (15 gal in 2011)
Serenade soil
Actinovate *Streptomyces*
Chicken manure - 10 tons
Chicken manure - 20 tons
Potassium - high rate

Impact of Management: chemicals/biologicals

soil microbiota of processing tomatoes, 2011 field study

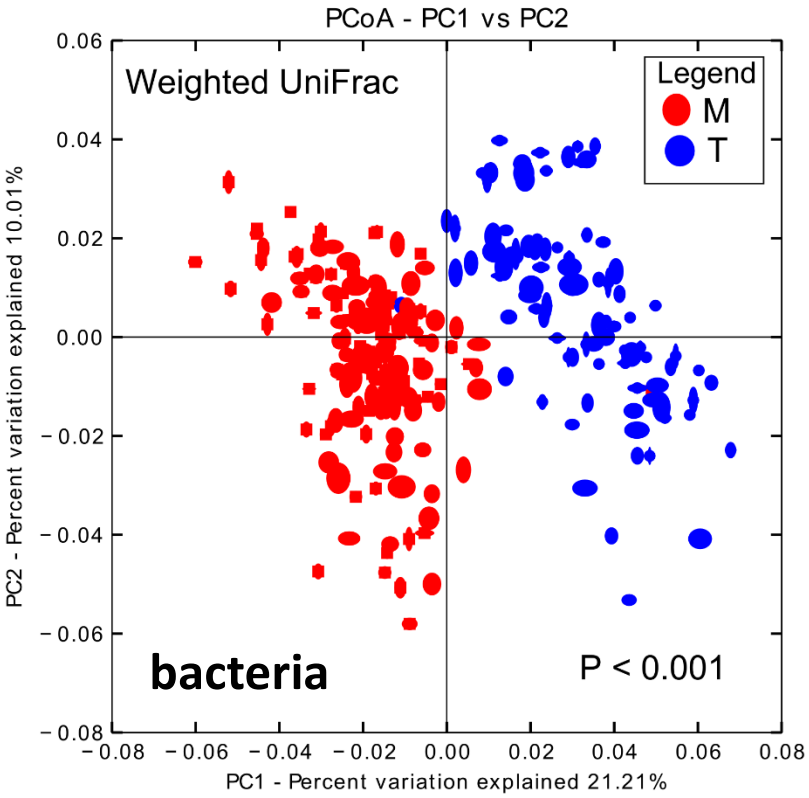


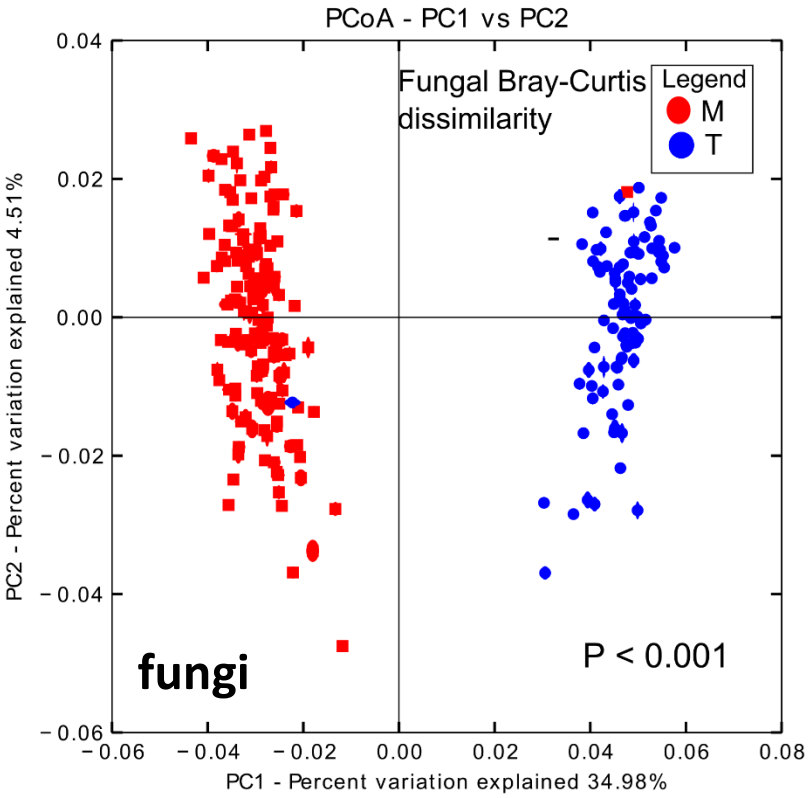
NT	nontreated
V	Vapam
Q	Quadris
R	Ridomil Gold
S	Serenade Soil (*Bacillus*)
T	Tenet (*Trichoderma*)
SG	SoilGard (*Gliocadium*)
CM	composted chicken manure

Johan Leveau, Professor
Dept Plant Pathology, UCD

IMPACT OF LOCATION

SOIL MICROBIOTA OF PROCESSING TOMATOES, 2011





Meek (shop) Woodland: Yolo silt loam

Timothy-Viguie (shop) Dixon: Yolo silty clay loam

both sites had tomatoes the previous year

distance between sites = 10.2 miles

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MOVEMENT OF *FUSARIUM OXYSPORUM* VIA EQUIPMENT

Fusarium wilt, race 3

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UNIVERSITY of CALIFORNIA

Fusarium wilt: ‘Mechanical spread’

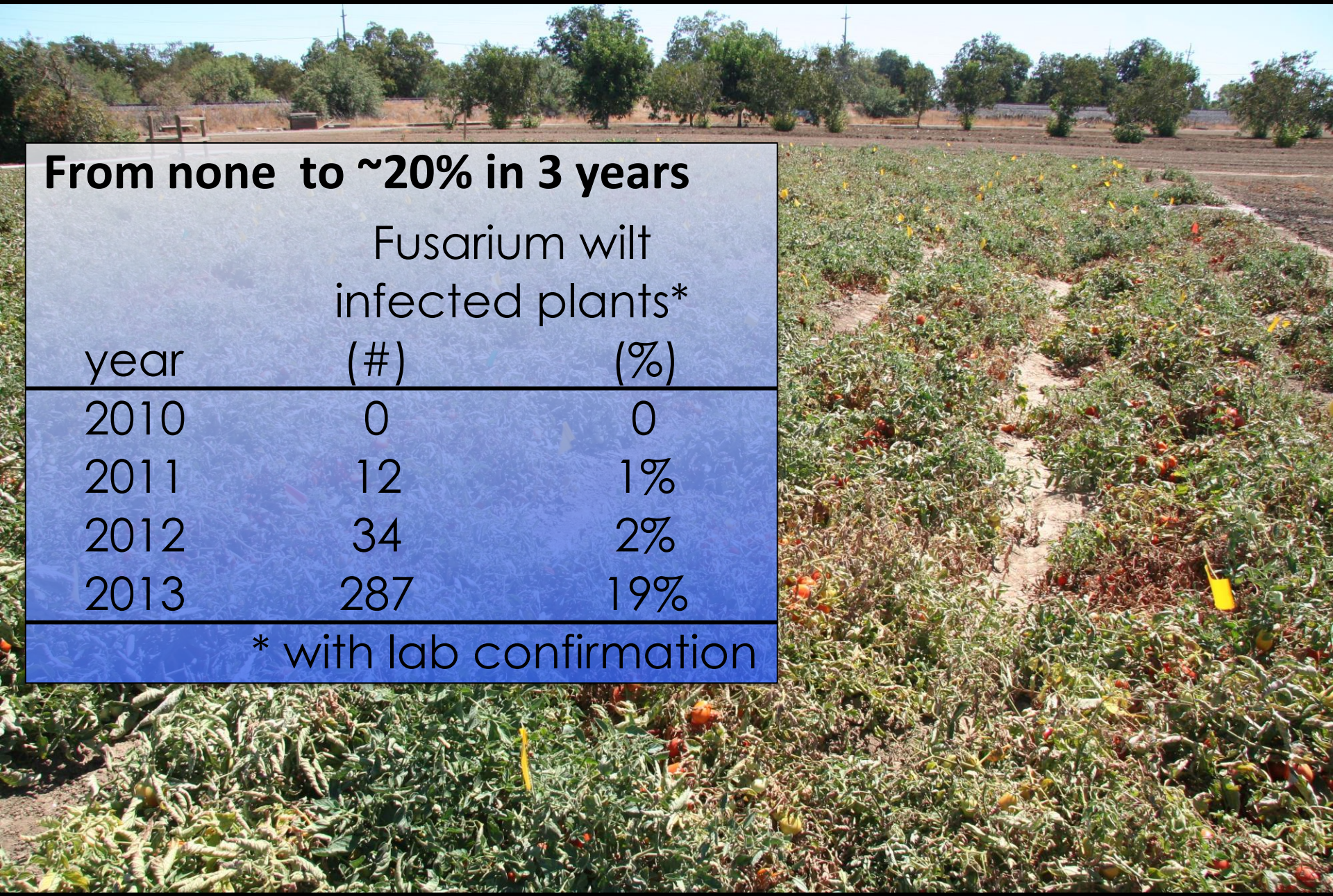
moving infested stem pieces...

...moving infested soil

California Tomato Research Institute

1st Year 2011

Fusarium wilt: ‘Mechanical spread’



From none to ~20% in 3 years

year	Fusarium wilt infected plants* (#)	(%)
2010	0	0
2011	12	1%
2012	34	2%
2013	287	19%

* with lab confirmation

Summary:

- ✓ Fusarium wilt, once introduced, can establish easily
- ✓ Fusarium wilt can spread quickly
- ✓ Fusarium is long-lived

Three Common Fusarium Diseases in Calif.

Fusarium wilt
F. oxysporum

Fusarium crown & root rot
F. oxysporum f. sp. radicis-lycopersici

Fusarium foot rot
F. solani

Three Common Fusarium Diseases in Calif.

Fusarium wilt
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The End