

Update on Crown and Root Diseases of Walnut

Greg T. Browne
Ravi G. Bhat
Leigh S. Schmidt

1 February 2013



Update on Crown and Root Diseases of Walnut

Back so soon??



Lethal Paradox Canker

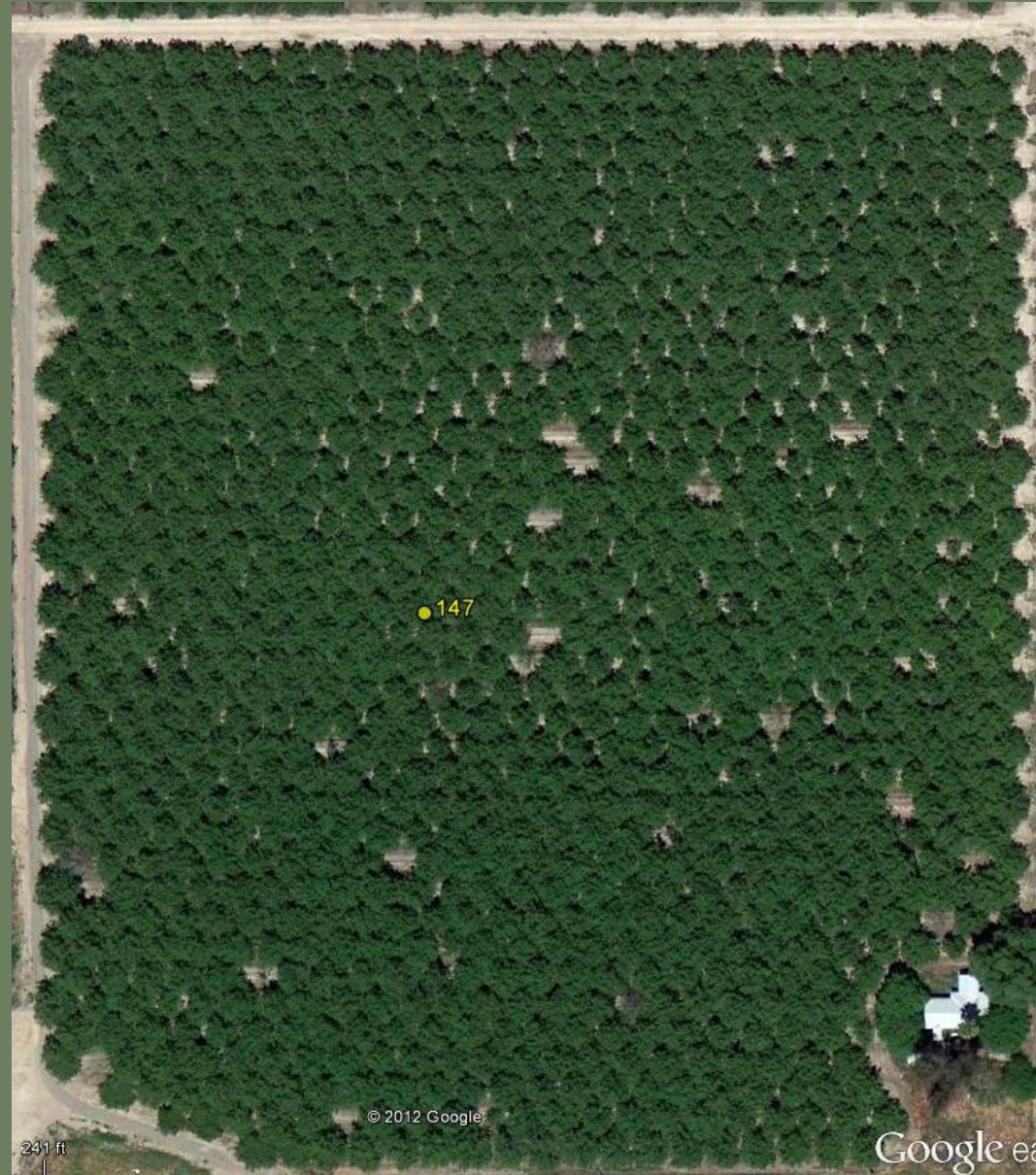
Update on Crown and Root Diseases of Walnut



Lethal Paradox canker- how much threat?



Near Tehama



Near Hanford

Lethal Paradox canker symptoms, Red Bluff



Lethal Paradox canker symptoms, Red Bluff



Results, 2012 culture isolations from LPC affected trees.



County	Orchard	Tissue health status	Number of trees yielding organism grouping / number of trees sampled				
			Light, raised-colony Unknown	<i>Phytophthora</i>	Mycelial fungi	Yeast-like	Bacteria and yeast
Fresno	H-EF	Necrotic	NM	0/4	4/4	2/4	4/4
		Necrotic	NM	0/10	2/10	4/10	5/10
		Necrotic	NM	0/1	1/1	1/1	1/1
		Necrotic	NM	0/2	1/2	1/2	2/2
		Necrotic	NM	0/3	1/3	0/3	1/3
	P-KA	Necrotic	1/1	0/1	0/1	1/1	1/1
Sutter	YM-BO	Necrotic	3/7	0/7	4/7	2/7	5/7
Tehema	RB-C1	Healthy	1/4	0/4	1/4	0/4	2/4
		Necrotic	4/4	0/4	2/4	1/4	2/4
		Necrotic	1/1	0/1	1/1	0/1	1/1
	RB-C2	Healthy	0/4	0/4	2/4	0/4	0/4
		Necrotic	4/4	0/4	2/4	0/4	2/4
Yolo	D-UC	Necrotic	1/1	0/1	0/1	0/1	0/1
Yuba	Y-KA	Healthy	1/5	0/5	0/5	0/5	2/5
		Necrotic	5/5	0/5	4/5	1/5	5/5

Results, 2012 culture isolations from LPC affected trees.



County	Orchard	Tissue health status	Number of trees yielding organism grouping / number of trees sampled				
			Light, raised-colony Unknown	<i>Phytophthora</i>	Mycelial fungi	Yeast-like	Bacteria and yeast
Fresno	H-EF	Necrotic	NM	0/4	4/4	2/4	4/4
		Necrotic	NM	0/10	2/10	4/10	5/10
		Necrotic	NM	0/1	1/1	1/1	1/1
		Necrotic	NM	0/2	1/2	1/2	2/2
		Necrotic	NM	0/3	1/3	0/3	1/3
	P-KA	Necrotic	1/1	0/1	0/1	1/1	1/1
Sutter	YM-BO	Necrotic	3/7	0/7	4/7	2/7	5/7
Tehema	RB-C1	Healthy	1/4	0/4	1/4	0/4	2/4
		Necrotic	4/4	0/4	2/4	1/4	2/4
		Necrotic	1/1	0/1	1/1	0/1	1/1
	RB-C2	Healthy	0/4	0/4	2/4	0/4	0/4
		Necrotic	4/4	0/4	2/4	0/4	2/4
Yolo	D-UC	Necrotic	1/1	0/1	0/1	0/1	0/1
Yuba	Y-KA	Healthy	1/5	0/5	0/5	0/5	2/5
		Necrotic	5/5	0/5	4/5	1/5	5/5

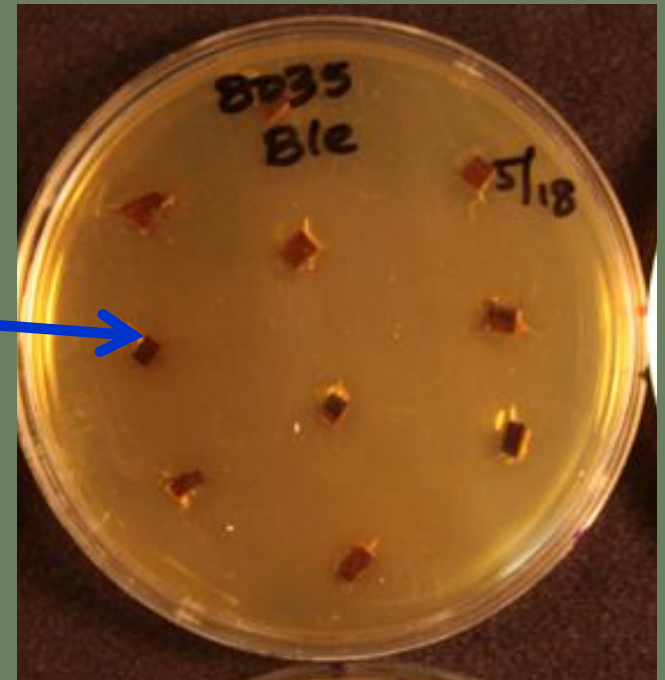
Results, 2012 culture isolations from LPC affected trees



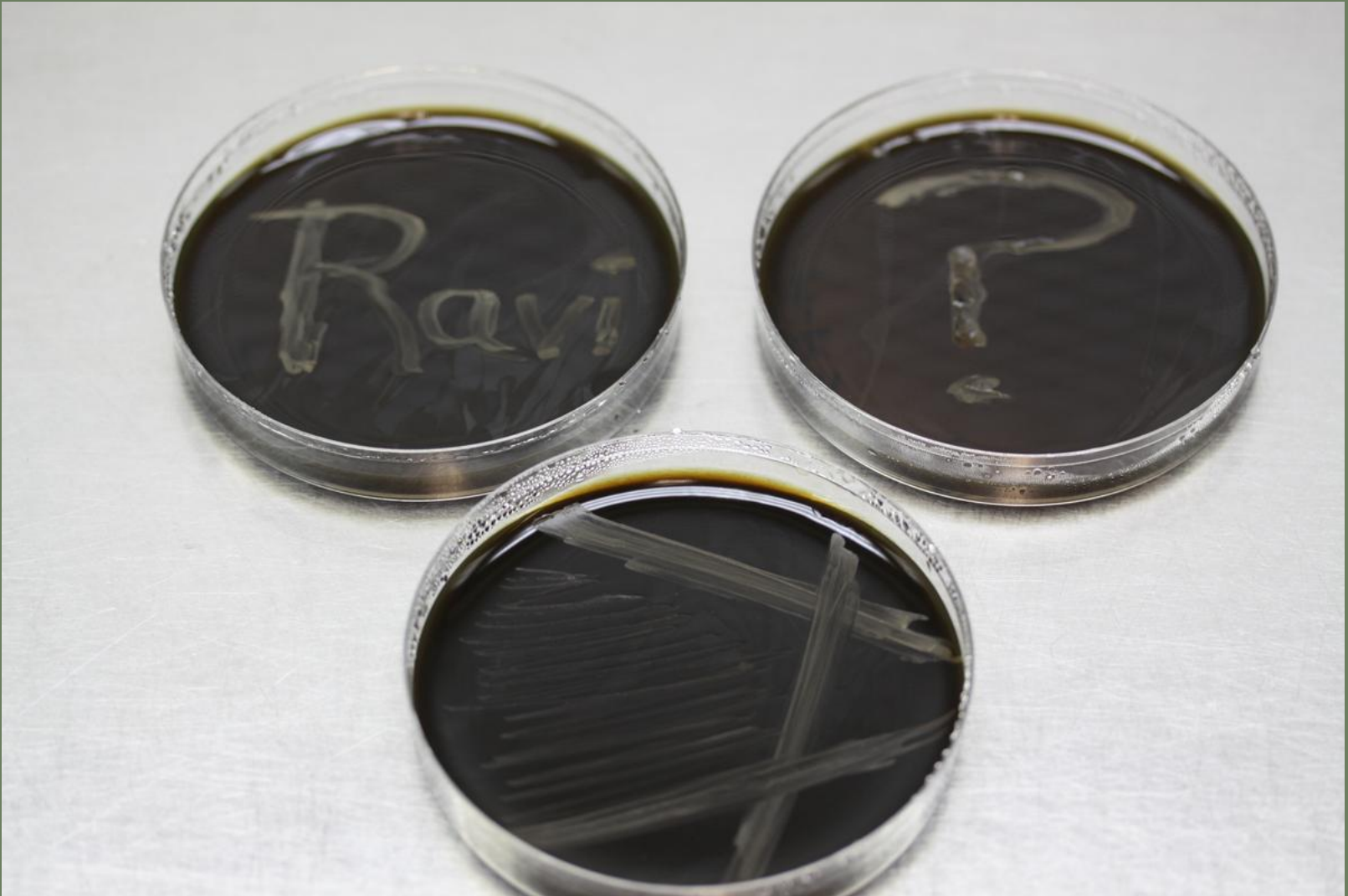
Orchard	Tissue status	Tissue pieces with organism / tissue pieces plated (and % pieces with organism)		
		LRCU	Mycelial fungi	Yeast fungi
RB-C1	"Healthy"	4/92 (4 %)	2/92 (2 %)	0/92 (0%)
	LPC-affected	91/164 (55 %)	6/164 (4 %)	14/164 (9 %)
	Value of <i>P</i> :	<0.0001	0.51	0.004
RB-C2	"Healthy"	0/92 (0 %)	4/92 (4 %)	0/92 (0 %)
	LPC-affected	62/164 (38 %)	5/164 (3 %)	0/164 (0 %)
	Value of <i>P</i> :	<0.0001	0.59	1.0

“Tour” of
“light raised-
colony
unknown
(LRCU)--

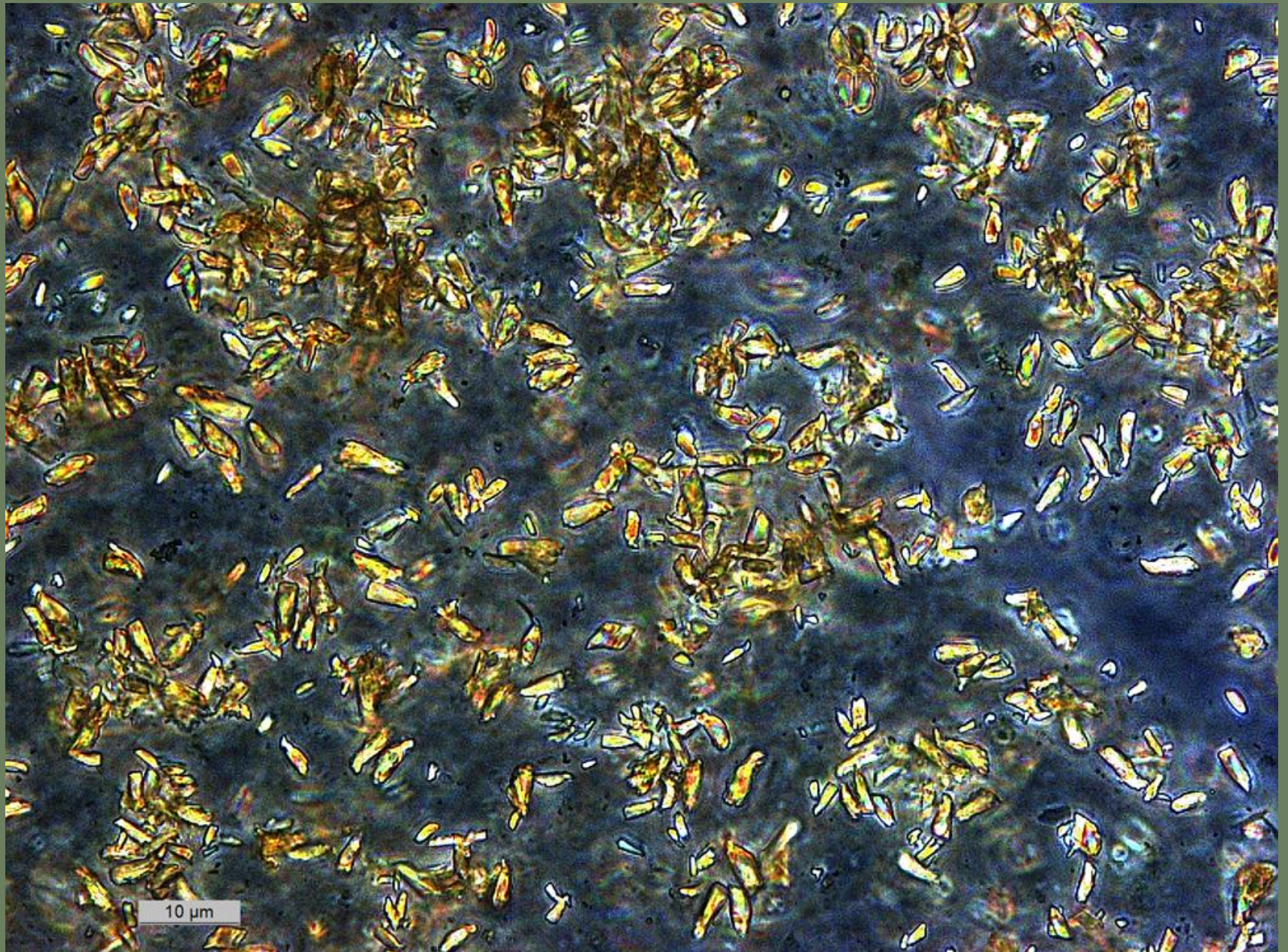
Isolation and
appearance in
culture



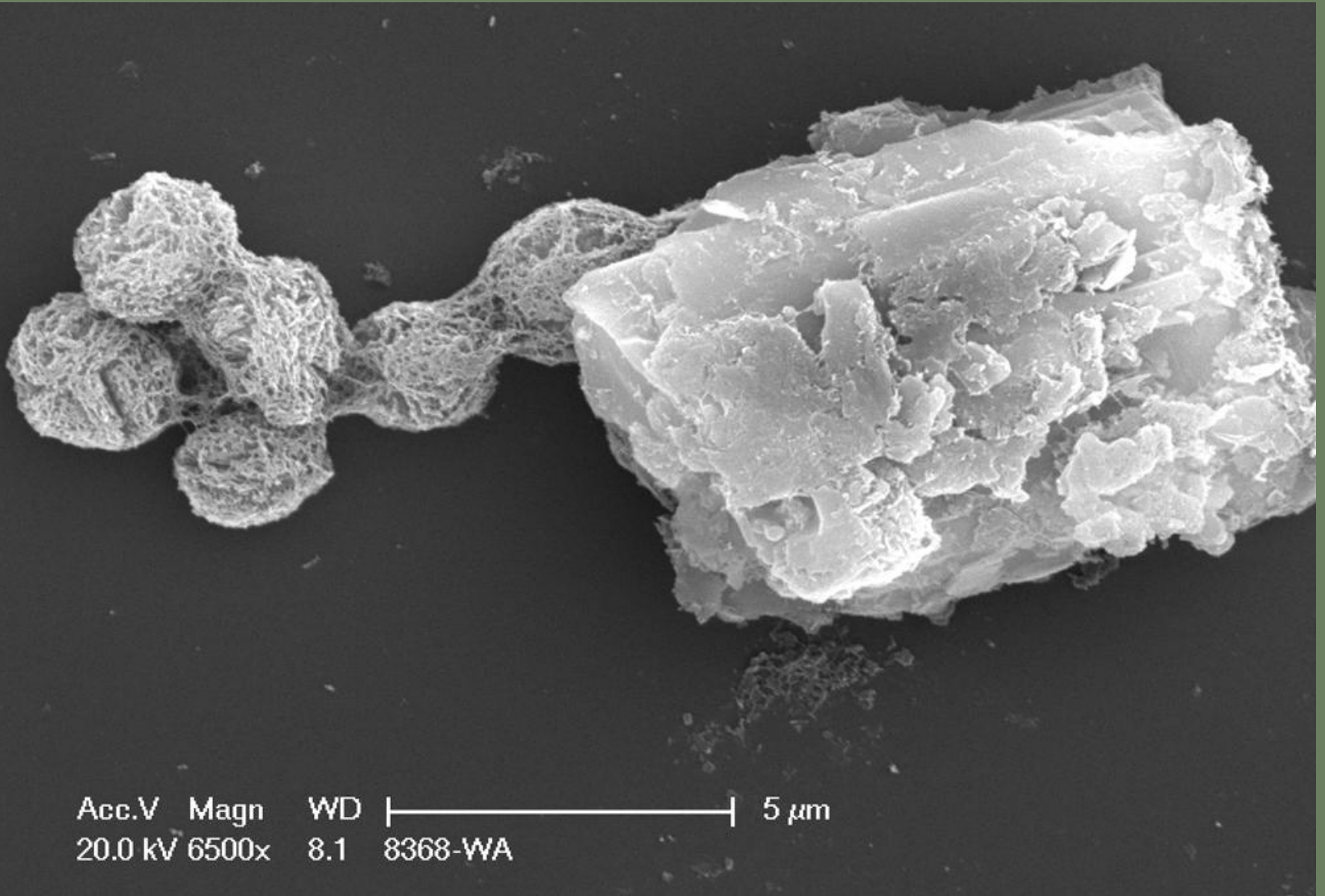
“Walnut bark agar”, an improvement allowing pure culture isolation “LRCU”



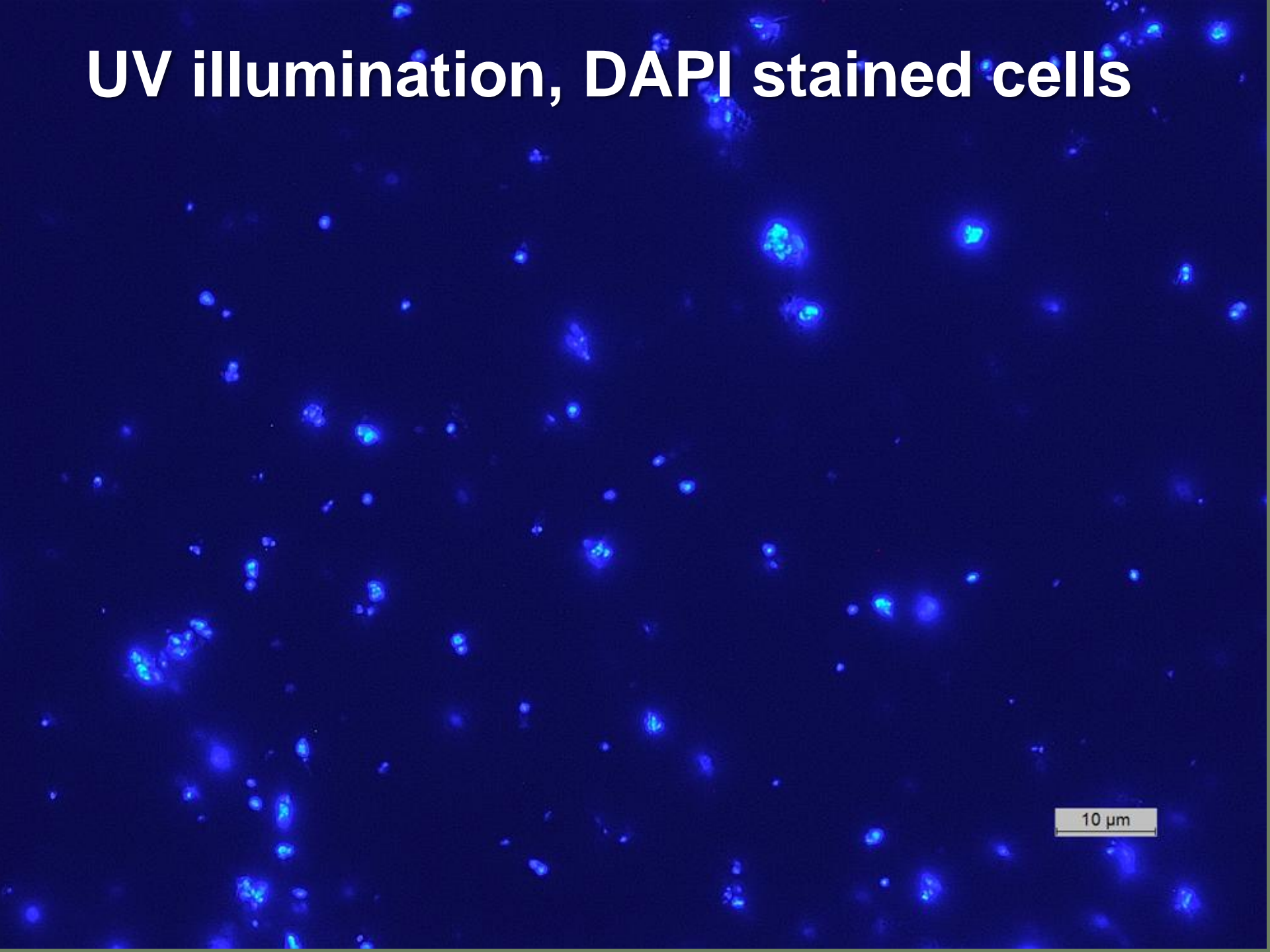
Light micrograph, fr. WBA culture, PH C, 1000x



SEM micrograph, from WBA culture



UV illumination, DAPI stained cells



10 μm

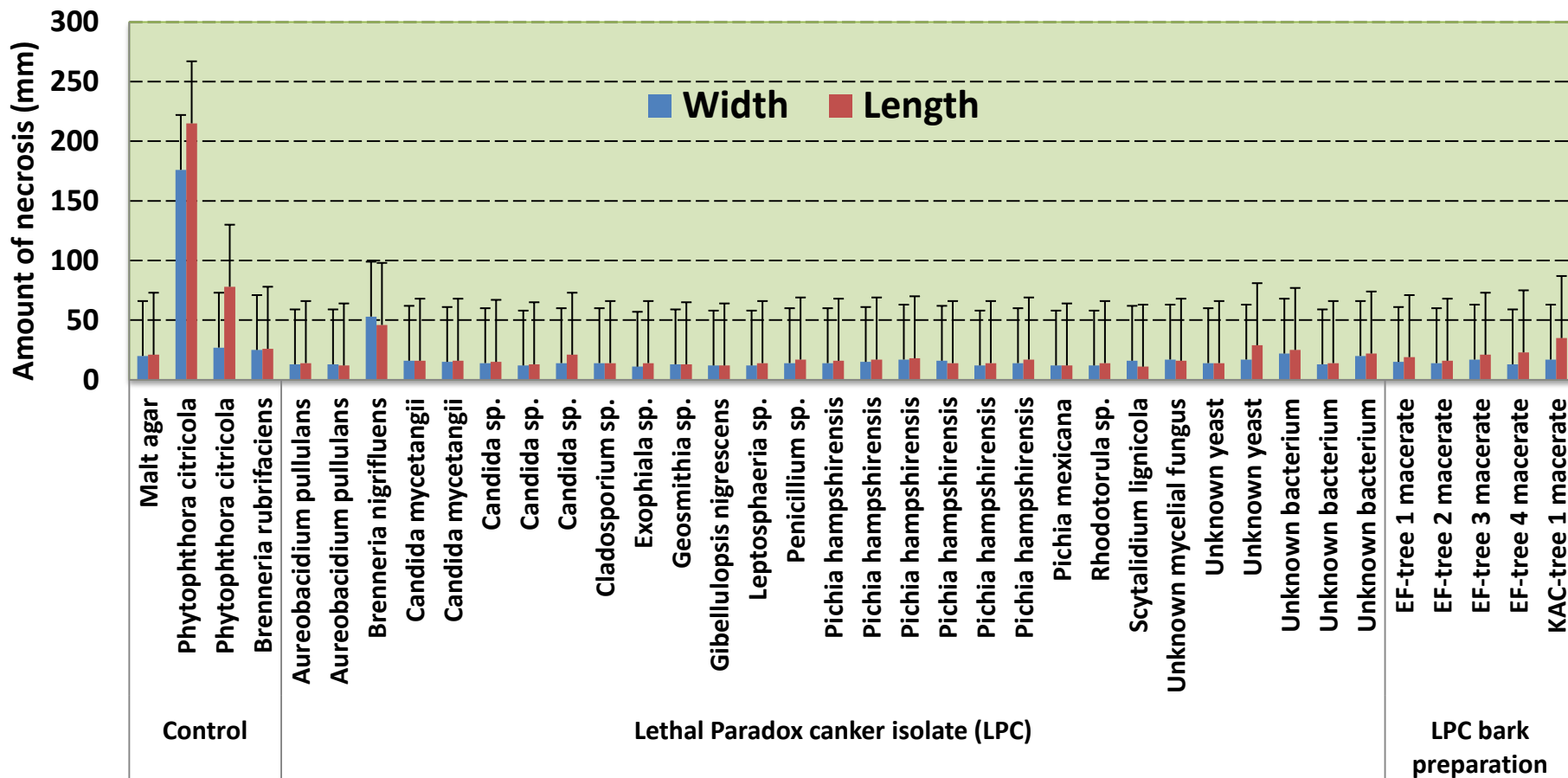
Pathogenicity testing at Kearney Ag Center, Parlier



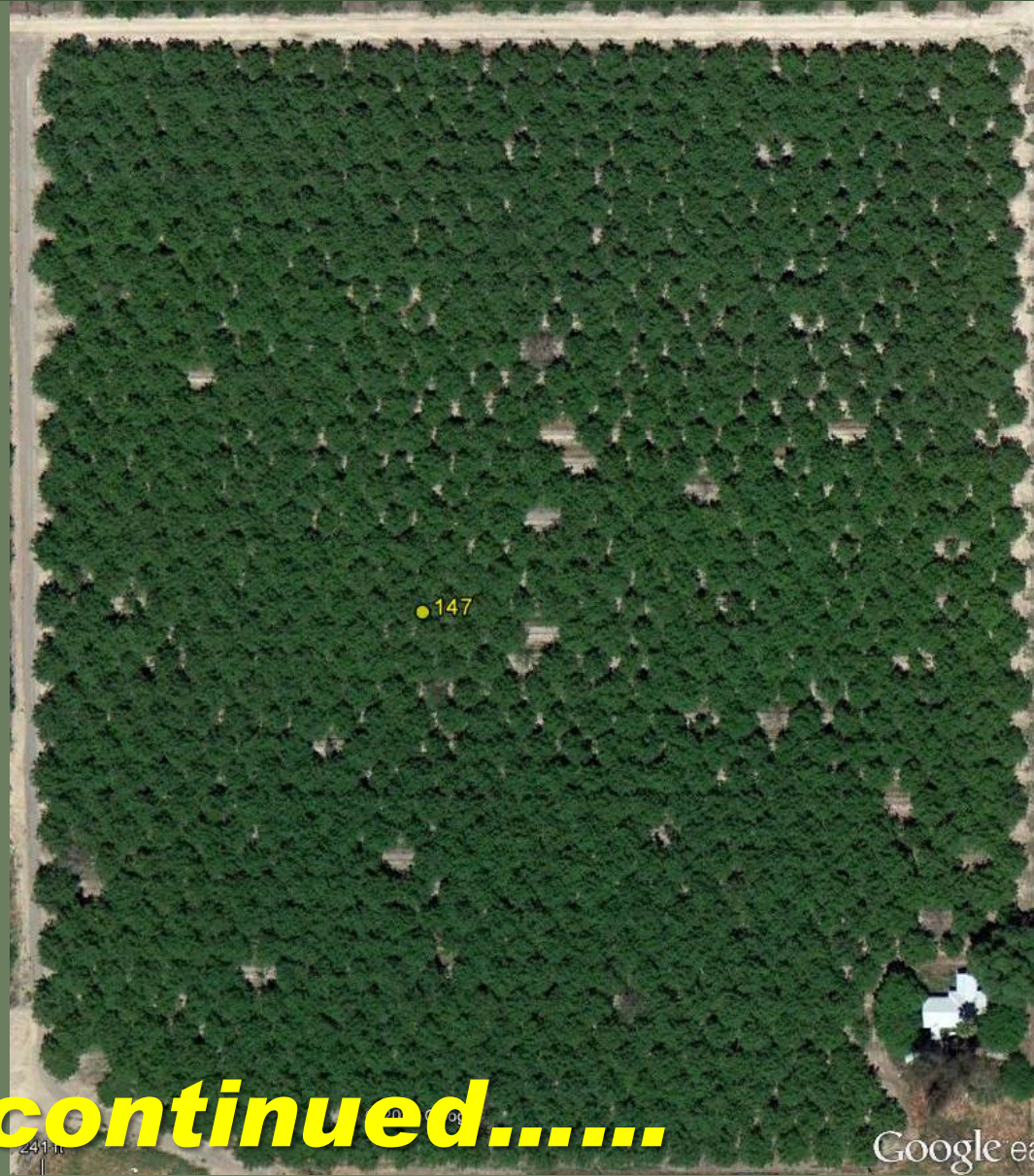
Methods

- Drill wound inoculations on Pdx
- Ex. 1 May-Nov
- Ex. 2 Nov-
(continuing)

Results of Ex. 1, pathogenicity testing at Kearney Ag Center, Parlier- canker meas.



So where do we stand now with LPC?



Too be continued.....

Phytophthora

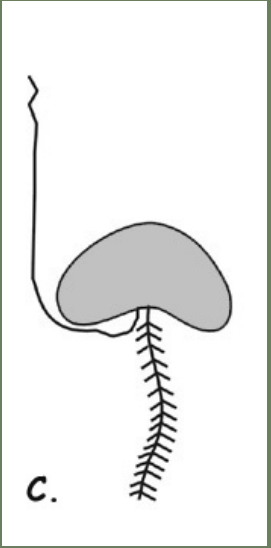
Photos: Wharton and Kirk, MSU



Oospore, note thick wall



Sporangium, note zoospores, (one swimming out)



Zoospore drawing, note flagella

Photo: Sullivan, NC State



Zoospores on root

Phytophthora on walnut

- Severe losses not common, but can be devastating
- Limited benefit from soil fumigation
- Careful soil water mgt. helps
- Phosphonates help
- Rootstock resistance helps

● HTA

406 ft

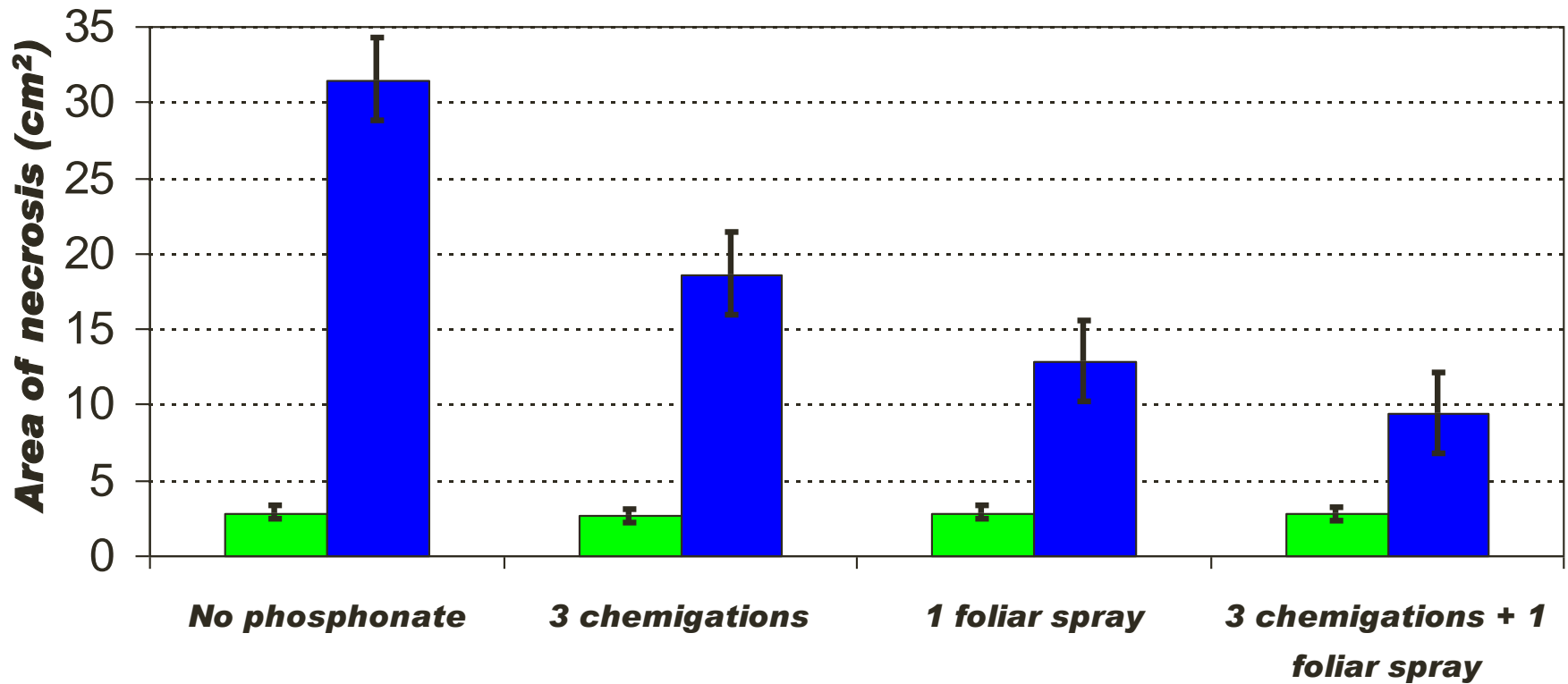
© 2012 Google

Google earth
● RMA

Efficacy of phosphonate treatments (3 qts./A),

- Trees inoculated 1 month after phosphonate treatments completed
- Cankers measured 3 months after inoculation

■ Non-inoculated ■ *Phytophthora citricola*



Examinations of genetic resistance to soilborne pathogens- key rootstock germplasm

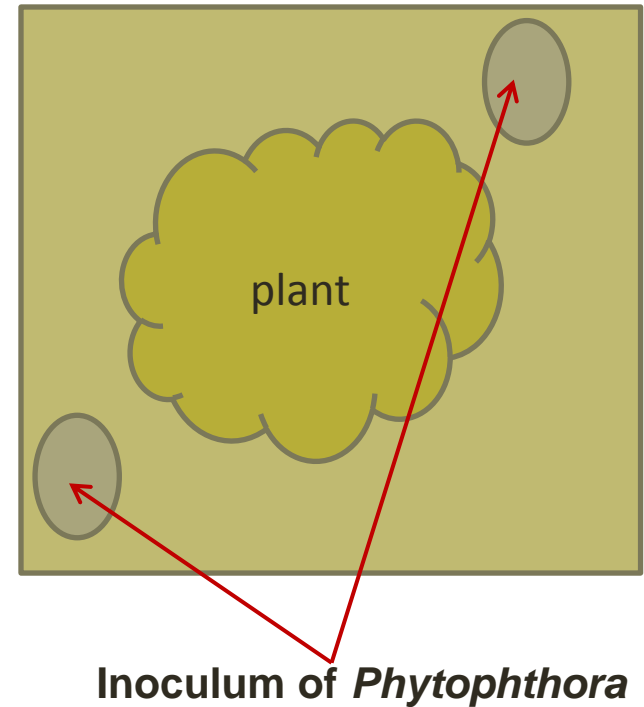
- *Juglans ailantifolia*
- *J. cathayensis*
- *J. major*
- *J. microcarpa*
- *J. hindsii*
- *J. regia* (hybridization)
- *Pterocarya stenoptera* (Res. std)



2011, 2012 evaluations of resistance to *P. cinnamomi* and *P. citricola*

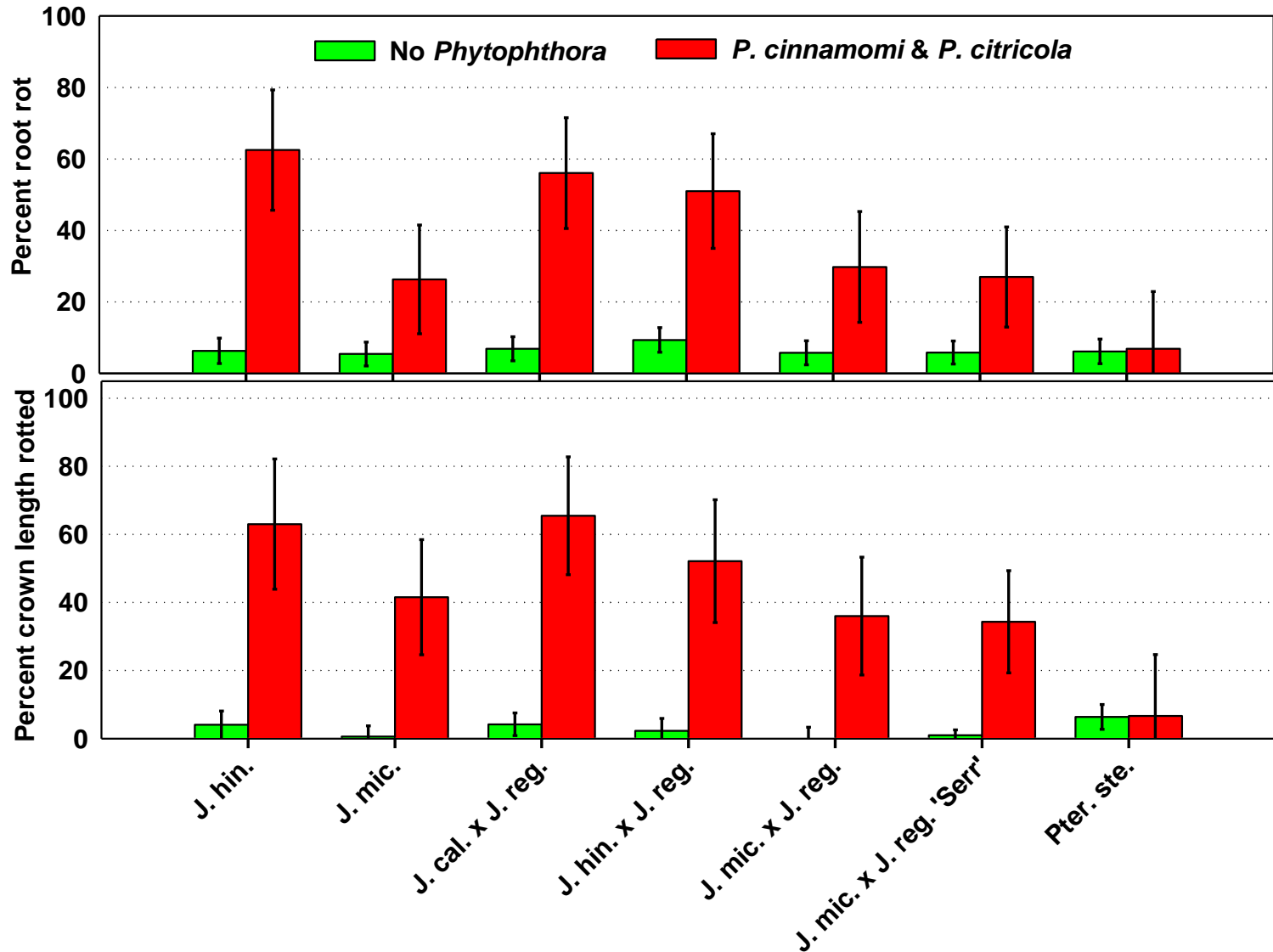
Background	Clone	2011	2012-1F	2012-2M	2012-3M	2012-4J	2012-5A	
<i>Juglans hindsii</i>	W17	+	+	+		+	+	
<i>J. microcarpa</i> , o.p.	JMOP2	+			+		+	
	JMS7	+	+	+	+			
<i>J. californica</i> x <i>J. regia</i>	AX1	+	+	+	+	+	+	
<i>J. hindsii</i> x <i>J. regia</i>	Px1	+	+	+		+	+	
	Vlach	+						
	VX211				+			
<i>J. microcarpa</i> x <i>J. regia</i>	RX1	+	+	+	+	+	+	
<i>J. microcarpa</i> x <i>J. regia</i> 'Serr'	29JM1					+	+	
	29JM3		+	+				
	29JM4		+	+	+			
	29JM5					+	+	
	29JM7	+			+			
	29JM8	+				+	+	
	29JM10		+	+	+			
	29JM11				+	+	+	
	29JM12	+			+	+	+	
	29JM22	+	+	+				
	JMS3	+	+	+				
	JMS4						+	+
	JMS5	+	+	+				
	JMS5A	+	+	+	+			
	JMS9		+	+				
	JMS11	+			+	+	+	+
	JMS11A						+	+
	JMS12	+			+	+	+	+
	JMS13				+	+	+	+
	JMS15	+			+	+	+	+
	29JM17			+	+			
	JMS18						+	+
	JMS19	+			+	+	+	+
	JMS20			+	+			
	JMS21			+	+			
	JMS24	+	+	+	+	+		
	29JM2			+	+			
	STJM4	+				+	+	+
	STJM6	+	+	+	+	+		
	STJM11	+	+	+	+	+		
	STJM7						+	+
	3s14						+	+
<i>Pterocarya stenoptera</i>	WNxW	+	+	+		+	+	

Evaluations of genetic resistance to *Phytophthora cinnamomi* and *P. citricola*, greenhouse method

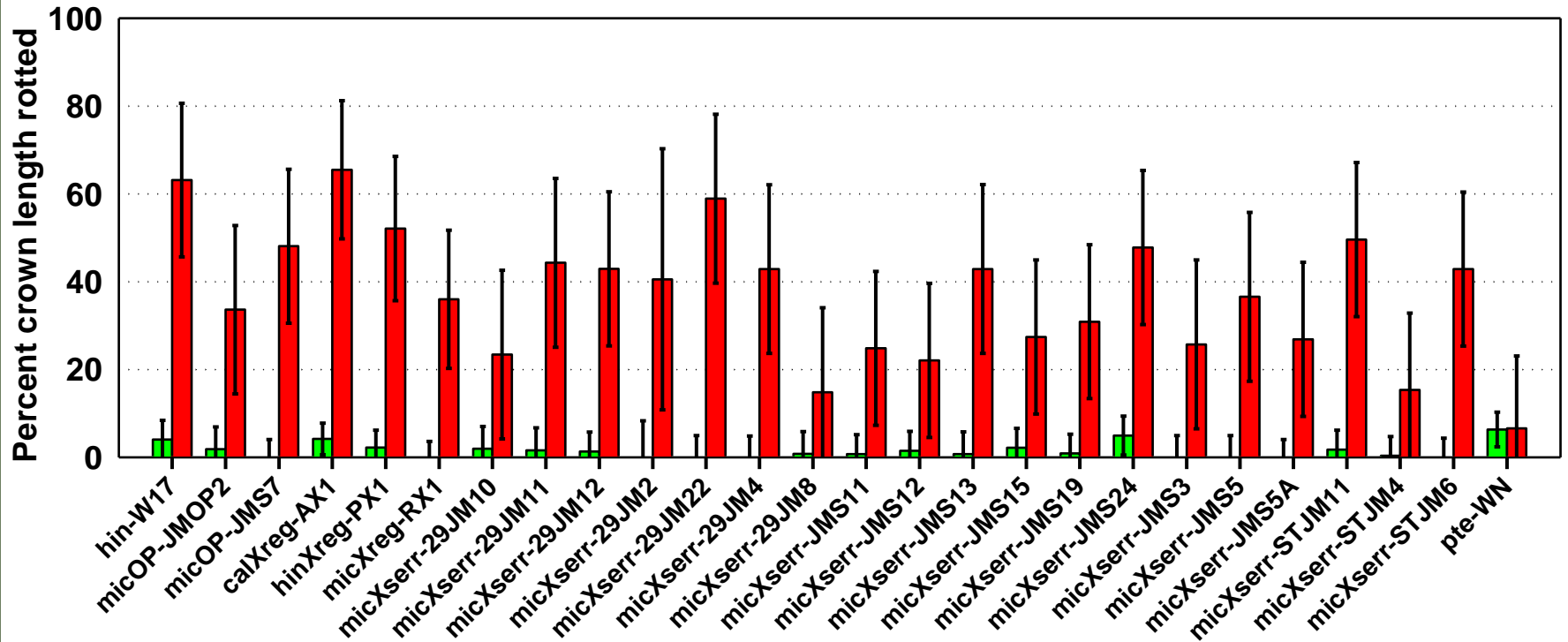


Rootstocks transplanted and screened 400-ml pots filled with Sunshine Mix amended with micronutrients

Summary of results by genetic background, all clones in 3 or more trials, using "experiment" as random factor



Summary of results by clone, all clones in 3 or more trials, using “experiment” as random factor



Field testing of RX1 rootstock, Joe Grant, UCCE Farm Advisor



7-15-2003



9-16-2011

Orchard area infested with *P. cinnamomi*



**Field validation of RX1 rootstock,
Joe Grant, UCCE Farm Advisor**

**RX1 and Paradox seedling
trees were planted April 2010;
there were 100 two-tree pairs**

Field testing RX1 (trees planted 2010 Joe Grant)

Yr	Rootstock	Mortality (%)
2010	Pdx sdg.	0
	RX1	0
2011	Pdx. sdg.	17 (+6)
	RX1	0
2012	Pdx. Sdg.	31 (+17)
	RX1	0

**P. cinnamomi* isolated from 54% of dead trees and 21% of poorly growing trees (2012).

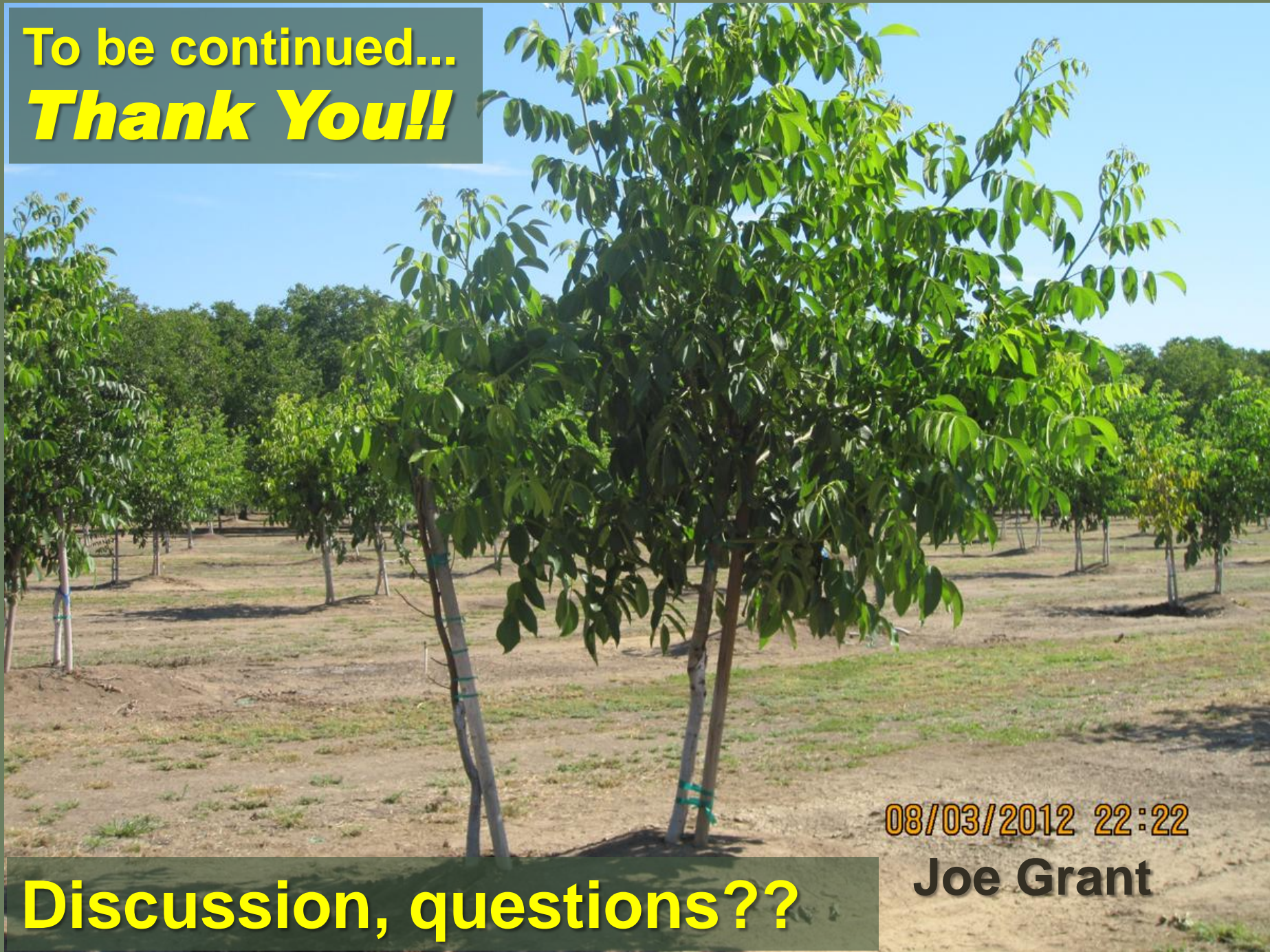




08/03/2012 22:22

Joe Grant

To be continued...
Thank You!!



08/03/2012 22:22

Joe Grant

Discussion, questions??