

Bed fumigation and other ways to live with the New EPA rules on soil fumigation



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Washington

- Deep shank injected
- Telone C-35, C-17, PC 60. Metam
- Non-tarped.
- Planting life 5-10 years



California

- Applied noble plow
- MB:pic, Telone C-35, PC 60
- Tarped, sometimes TIF
- Planting life 1.5-5 years

Phase 2 fumigant labels

In effect now

Label requirements are very complex!!!



- Fumigation management plans
- Responder/community outreach
- Applicator training
- No applications near sensitive areas
- **Buffers and buffer credits**
- Posting
- Emergency preparedness

22 Acre Raspberry
field (yellow block)
fumigated with
Telone C-35, 39
gallons/A, no tarp

Broadcast
fumigated,
625 ft buffer

Bed fumigated with
VIF tarp,
25 ft buffer



Grower Trials of Bed Fumigation

Five trials established in raspberry fields:

- Lynden 1, non-replicated, substantial *P. rubi* and *P. penetrans*
- Lynden 2, replicated, low *P. penetrans* and *P. rubi*; Also trialing non-tarped bed
- Lynden 3, replicated, substantial *P. penetrans*
- Burlington, replicated, high *P. penetrans* and *P. rubi*; Also trialing middle row management
- Mount Vernon, replicated, high *P. penetrans*

Treatments applied Sept 2010, raspberries planted April 2011



Treatment and evaluation timeline

- Soil fumigated: Sept 2010 (Lynden and Burlington trials), 2011 (Mt Vernon trial)
- Raspberries planted April-May 2011
- Primocane growth measurements, December 2011
- Yield evaluations, July 2012
- Soil bioassay for *P. rubi*, October 2011 (and annually thereafter)
- *P. penetrans* extraction from soil and from roots, April and October of each year



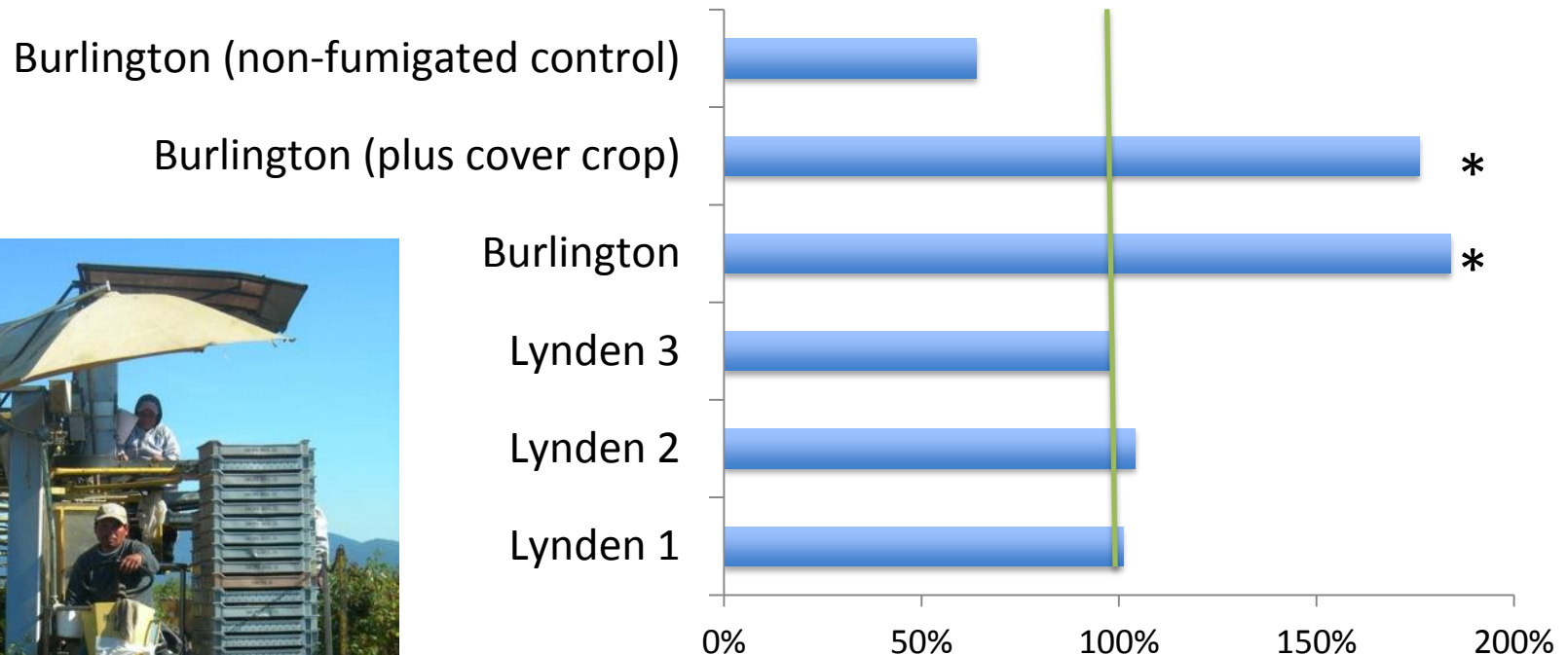
Cane Height (cm) 2011

	Burlington	Lynden 1	Lynden 2	Lynden 3	Mount Vernon
Non-fumigated	130 c	--	--	--	46
Bed fumigated	166 a	140	201	258	54
Bed fumigated (custom applicator's apparatus)	--	--	--	--	60
Bed fumigated+cover crop	146 b	--	--	--	--
Broadcast fumigated	137 bc	139	218	244	56
<i>P-value</i>	0.0012	<i>n/a</i>	0.1002	0.4	0.29

Plants in bed-fumigated plots generally grew as well as those in broadcast-fumigated plots.

2012 Harvested fruit weight, bed fumigated plots: percent of fruit weight from broadcast-fumigated plots

Harvested fruit weight from bed fumigated plots as percent of
fruit weight from broadcast-fumigated plots



Bed-fumigated plots were as productive as broadcast-fumigated plots, sometimes much more productive

P. rubi bioassay, 2011

Root rot control in bed-fumigated plots has been as good as in broadcast treated plots so far



Root rot severity		Burlington	Lynden 1	Lynden 2	Lynden 3	
<i>beds</i>						
	Non-fumigated	5.5	--	--	--	
	Bed fumigated, tarp	5.8	6.0	4.0	2.3	a
	Bed fumigated, tarp+cover crop	4.3	--	--	--	
	Broadcast fumigated	4.8	7.0	3.8	5.3	b
	<i>P-value</i>	0.68	<i>n/a</i>	0.70	0.05	
<i>alleyways</i>						
	Non-fumigated	6.3	--	--	--	
	Bed fumigated, tarp	6.0	7.0	3.8	6.7	b
	Bed fumigated, tarp+cover crop	6.0	--	--	--	
	Broadcast fumigated	6.5	6.0	4.3	4.0	a
	<i>P-value</i>	0.90	<i>n/a</i>	0.80	0.01	

P. rubi bioassay, spring 2013

In some trials, less root rot in
alleyways than in beds.
No treatment differences.



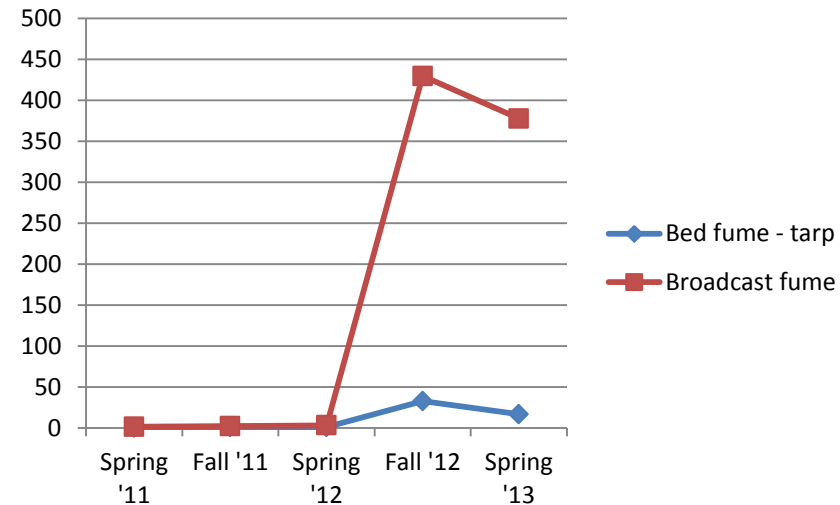
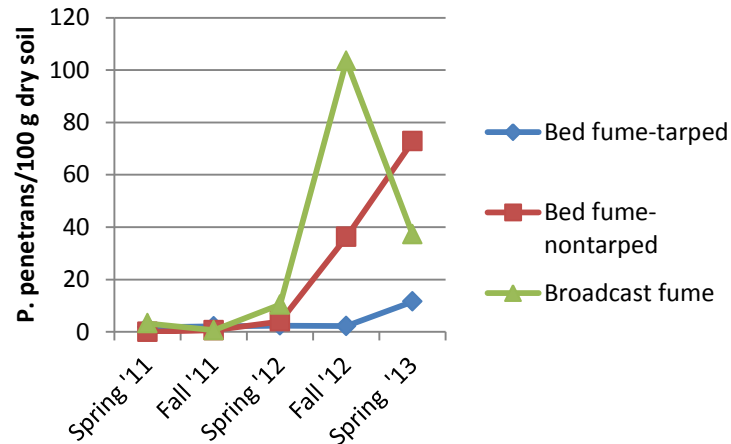
Root rot severity	Burlington	Lynden 1	Lynden 2	Lynden 3
<i>Sampling location</i>				
alleyways	5.6 a	5.8	4.1	2.7 a
beds	6.8 b	6.0	3.8	7.0 b
<i>Fumigation treatment (all sampled from beds)</i>				
Non-fumigated	6.3	--	--	--
Bed fumigated, tarp	7.3	7.0	4.0	6.3
Bed fumigated, tarp+cover crop	6.8	--	--	--
Broadcast fumigated	7.0	5.0	4.0	7.7

Nematode recolonization in bed- and broadcast-fumigated plots

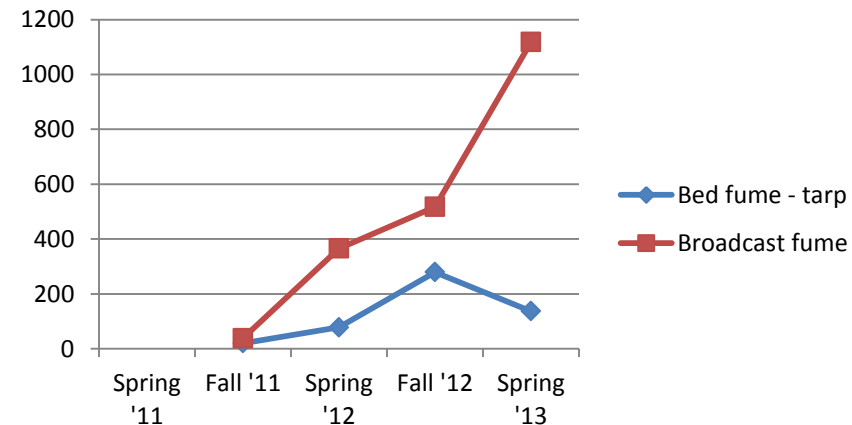
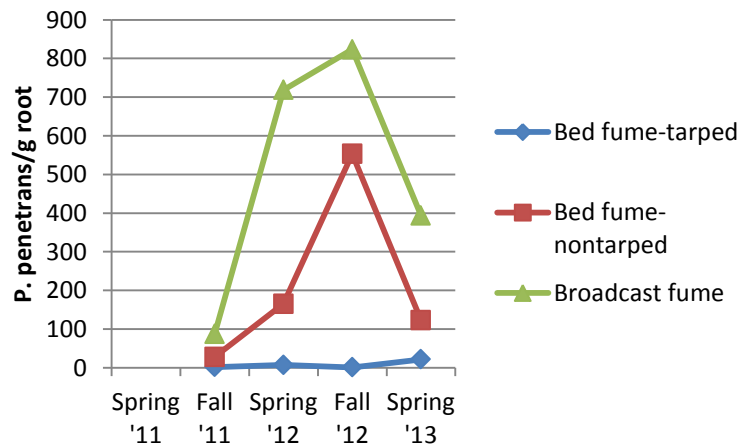
Lynden 2

Lynden 3

From Soil



From Roots

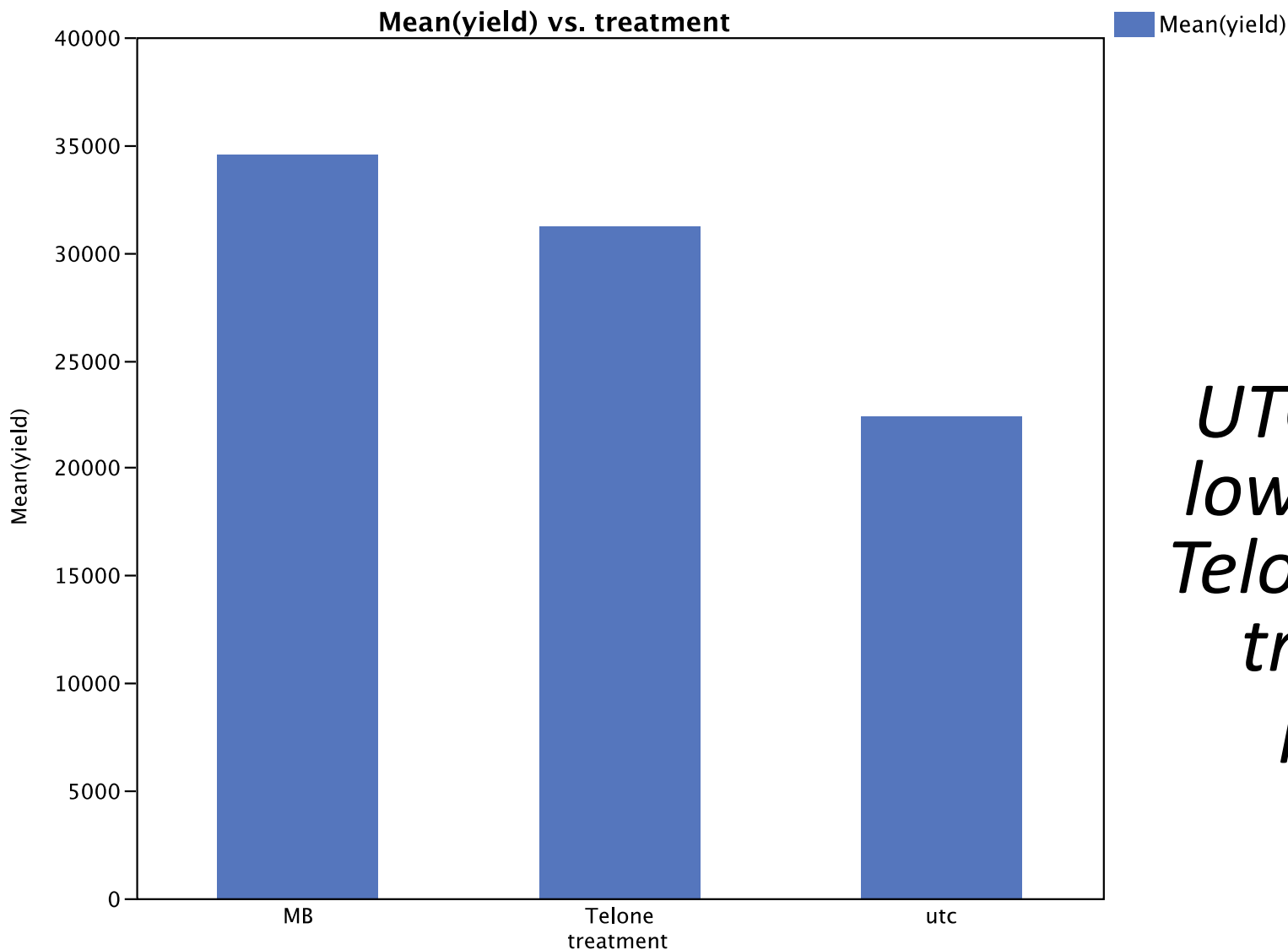


Challenges:

- The shaper we used (an adjustable unit for vegetables) can only make beds up to about 8" high. You'd need a different shaper to make **larger beds**.
- You'll need GPS or some other way to assure that beds are made in the correct **location**.
- It takes **more time** to fumigate a field this way; we usually travel at about 3 mph when fumigating and laying tarp. (Broadcast rig travels about 5-6 mph.)

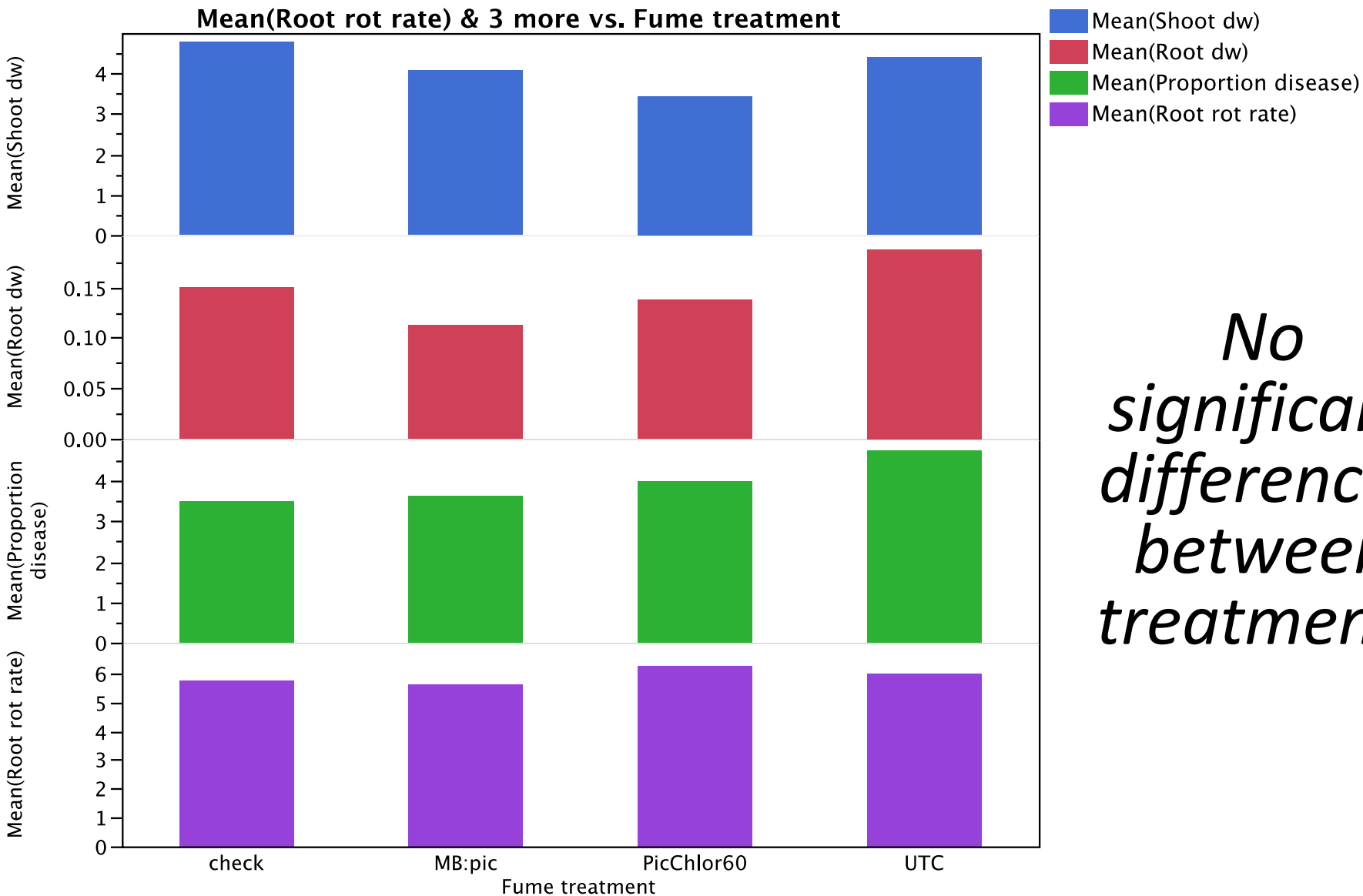


Yield-California trial, fall 2011



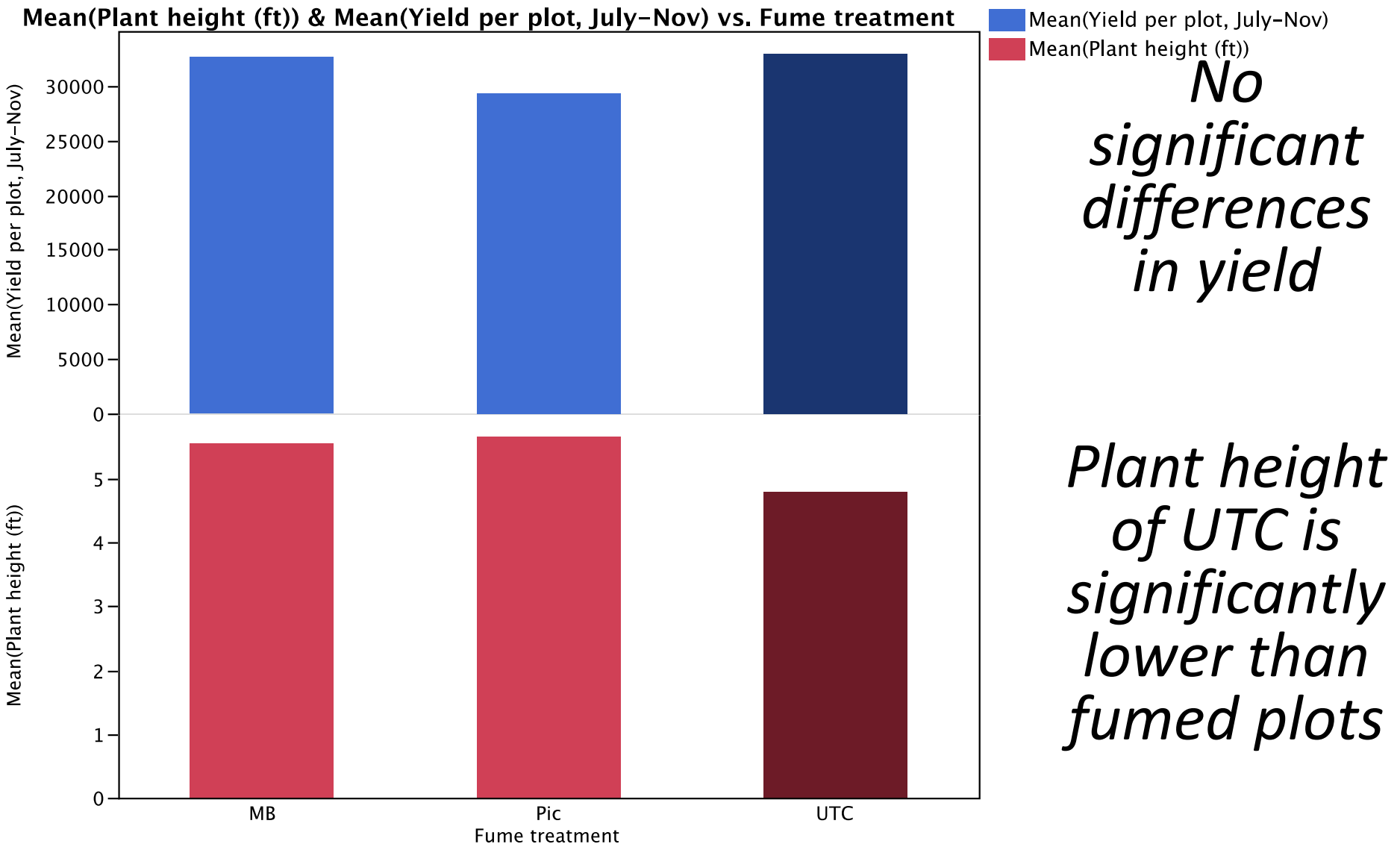
*UTC yields
lower than
Telone, MB-
treated
plots*

Phytophthora bioassay-California trial, Spring 2012

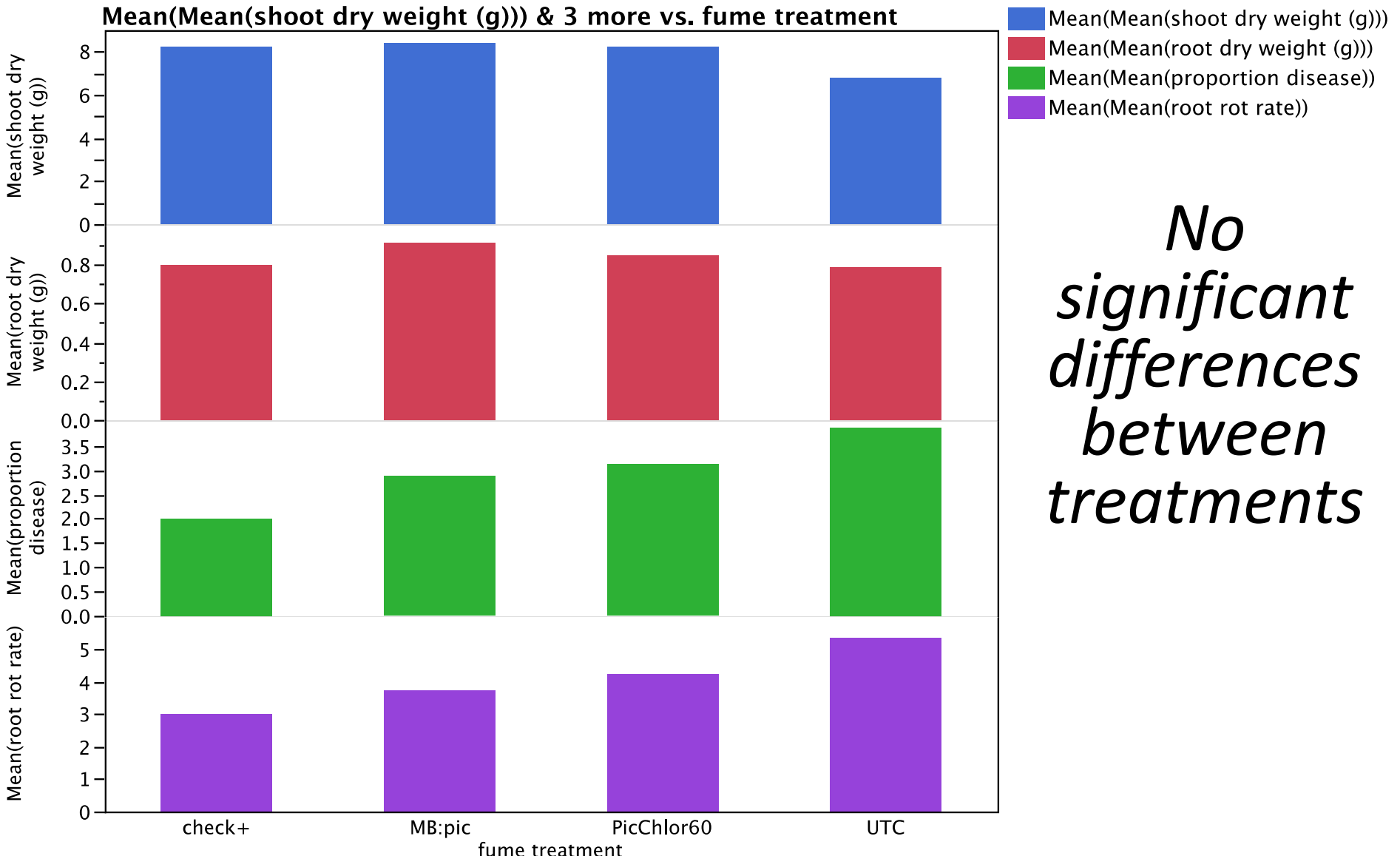


*No
significant
differences
between
treatments*

Yield and Plant Height-California trial, fall 2013



Phytophthora bioassay-California trial, fall 2013



Another option-metam (Vapam)

- Telone C-35, deep shank injected
 - 35 gal/A
 - 20 A field
 - 20% credit for 2-3% organic material
 - 460 ft buffer
- Vapam HL, applied with rotary spader
 - 75 gal/A
 - 20 A field
 - 20% credit for 2-3% organic material
 - 96 ft buffer
 - ?Less volatile?

Applying Vapam with a rotary spader



Applying Vapam with a rotary spader



About 75% of the fumigant is injected in these sweeps near the front of the spader

Applying Vapam with a rotary spader



Spader blades rotate slowly, mixing soil and Vapam

Sweep

Applying Vapam with a rotary spader



Power
roller

Spader
blade

Remaining 25% of Vapam is injected ahead of this shallow power harrow

Applying Vapam* with a rotary spader



Seal generated by power roller

*Relax. They are just applying water in this demonstration.

Other options?

- Paladin (Dimethyl Disulfide)
 - Effective, strong smell
 - Must be applied under VIF or TIF tarp
 - 25 ft buffer for bed applications
- Mustard meals
 - Effective in greenhouse tests, less encouraging in field
 - Incorporate with rotary spader?
 - Mustard variety matters

Thanks!!

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