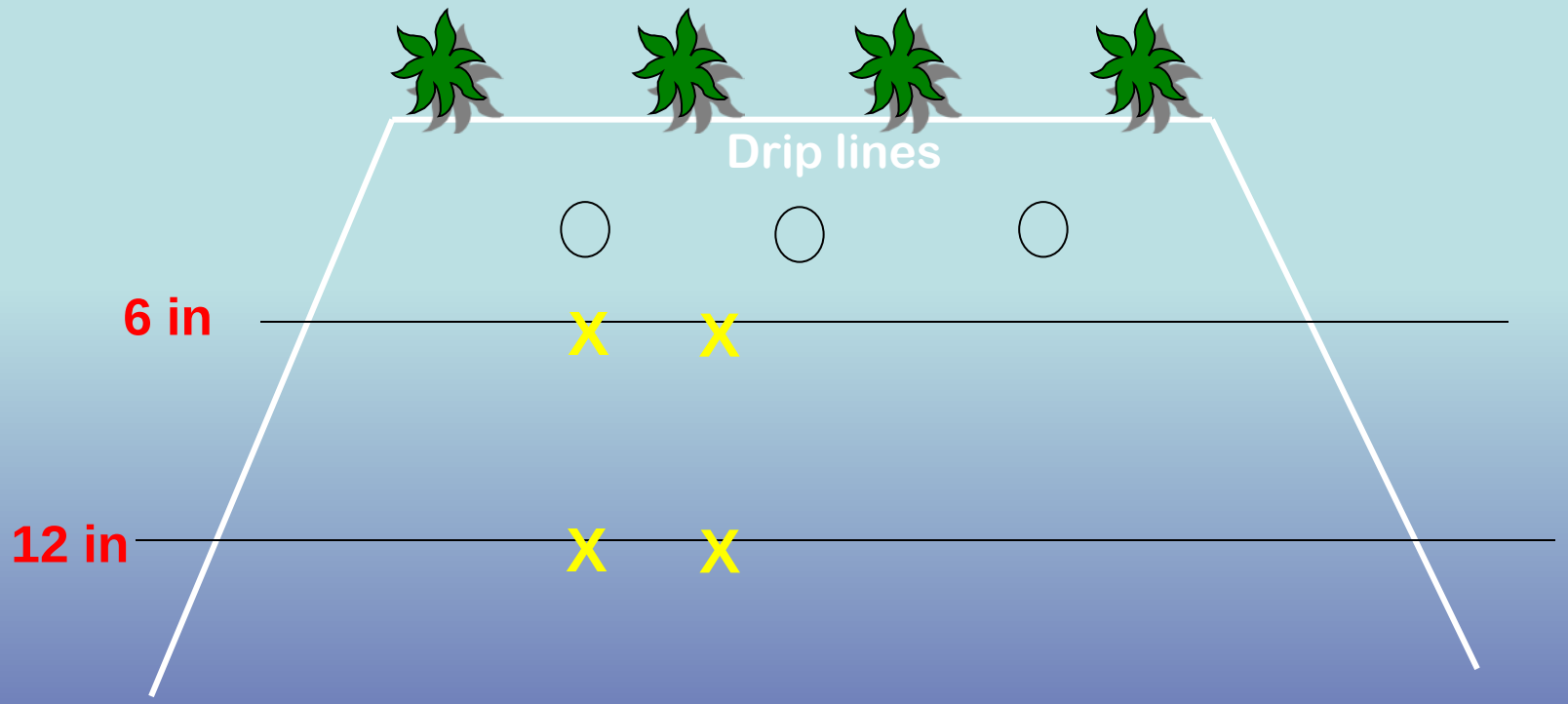
What else can we do with drip fumigation?

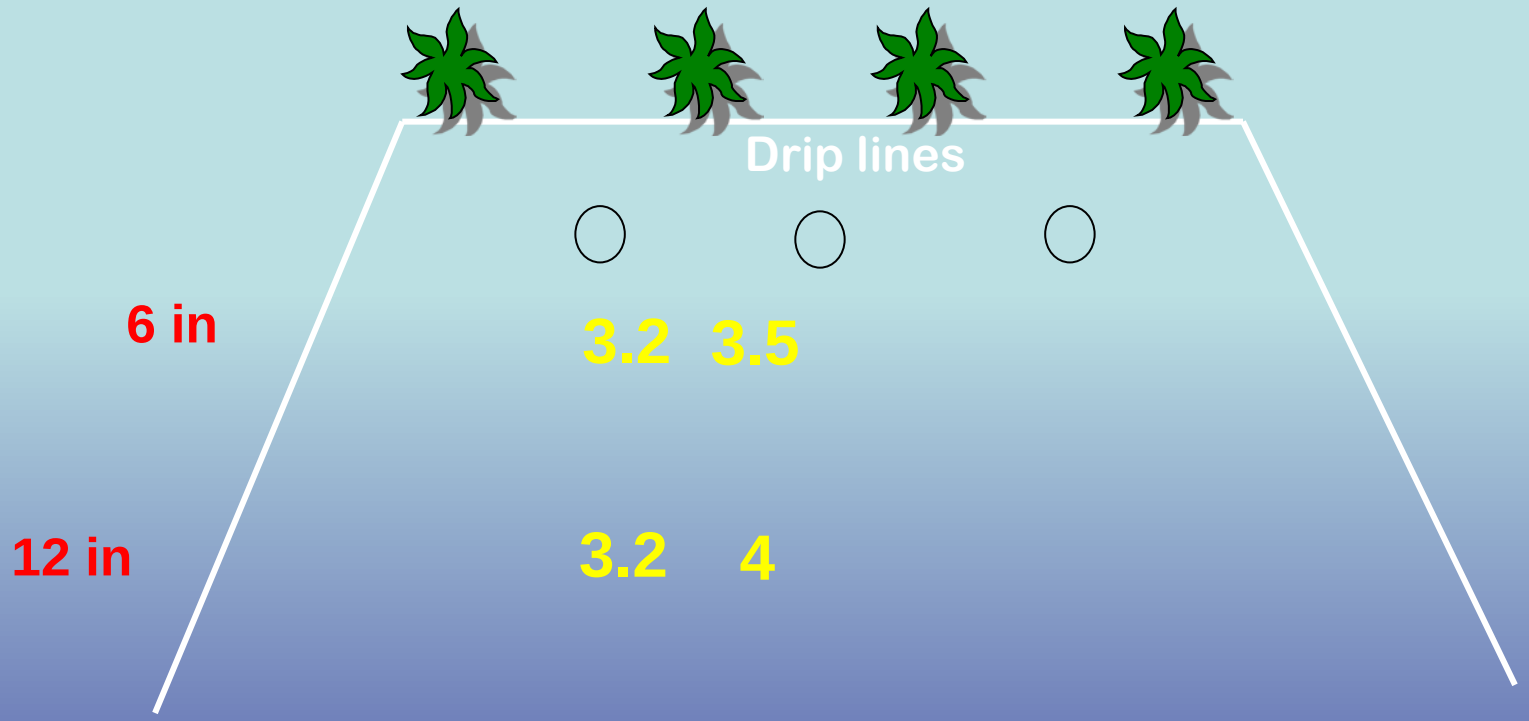
Oleg Daugovish, Anna Howell, Bill Rutan, Steve Koike (UC- ANR), Tom Gordon and Ruijun Qin (UC –Davis), Suduan Gao and Jim Gerik (USDA)

End of the season Vapam via drip 50 gal/acre

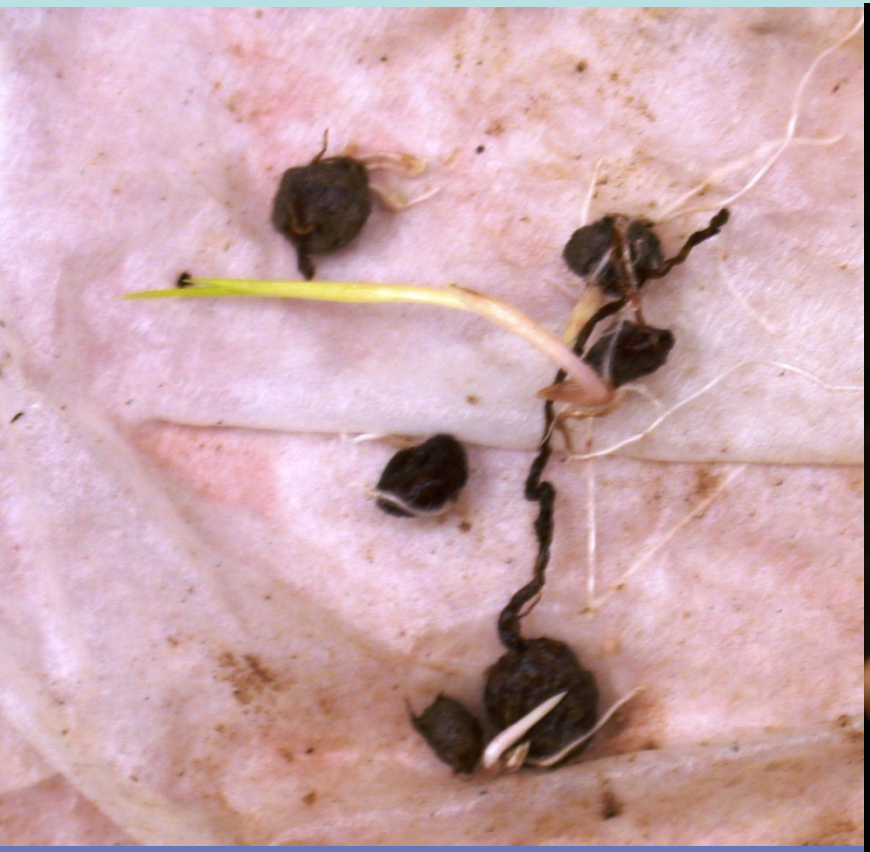


Yellow nutsedge shoots / 4 tubers

UNTRETED CHECK: 80-100% germination

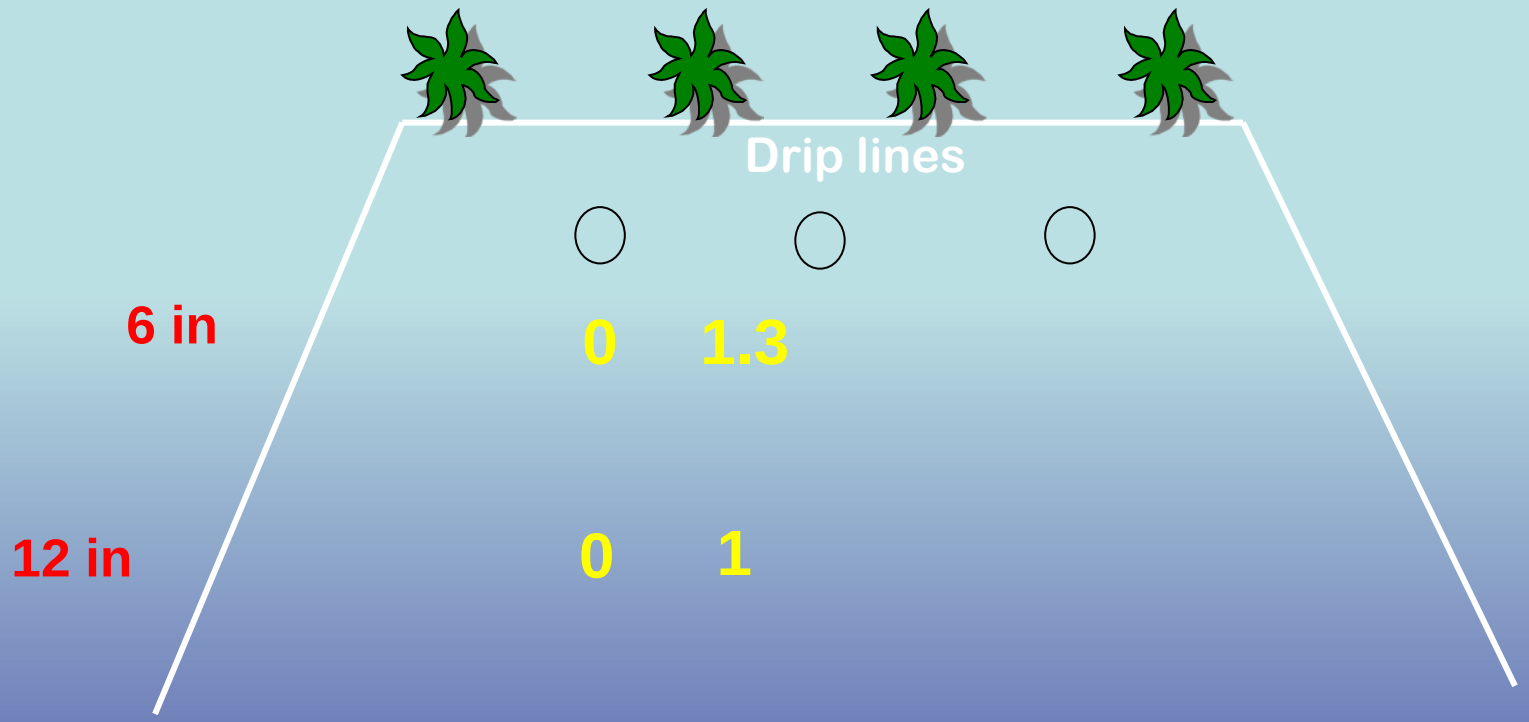


UNTREATED CHECK



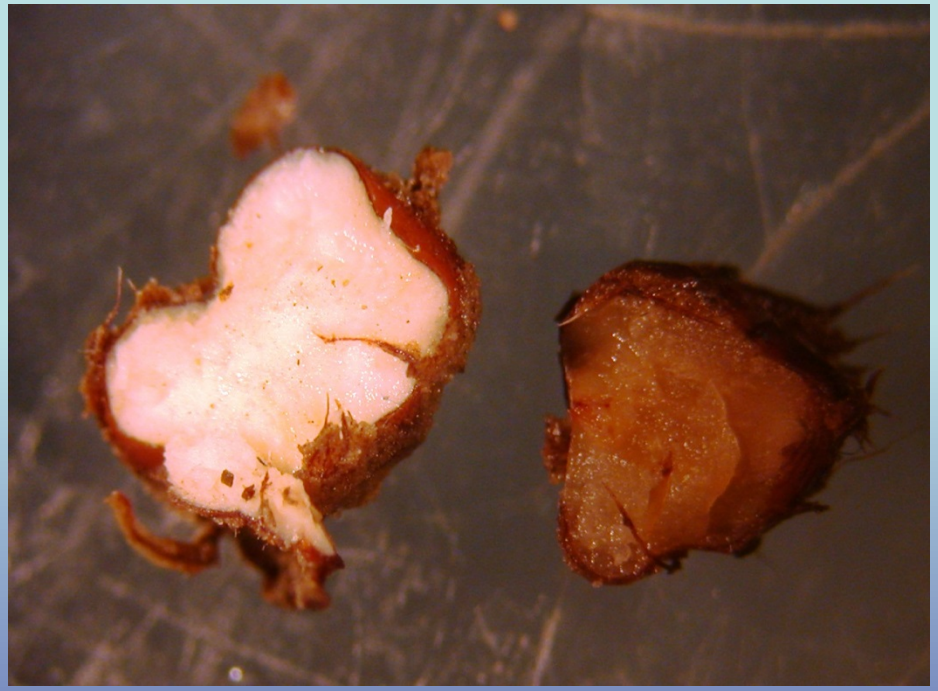
Yellow nutsedge shoots / 4 tubers

VAPAM: 0 to 33% germination



Depth was not important but location was

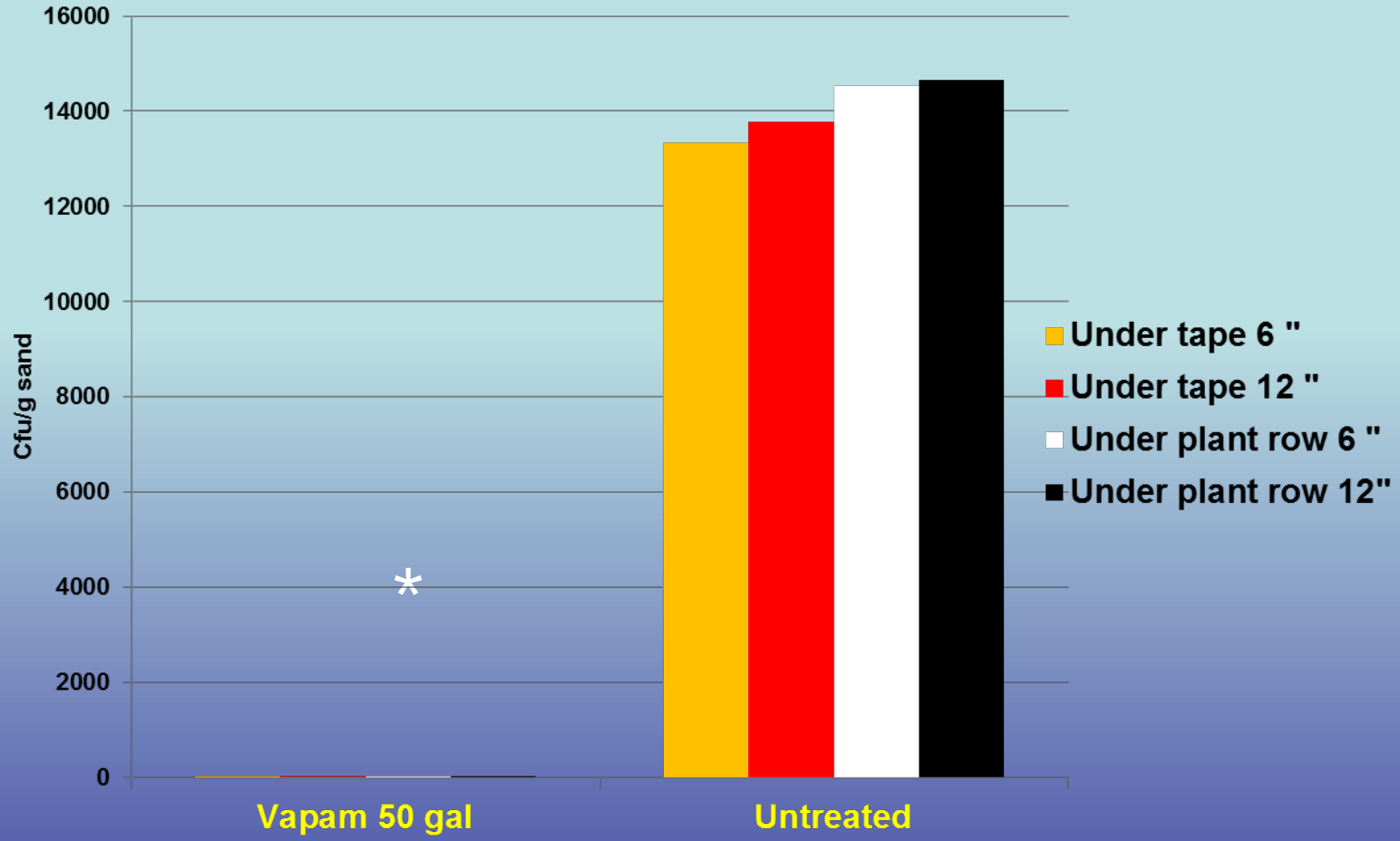
After VAPAM in PLANT ROWS



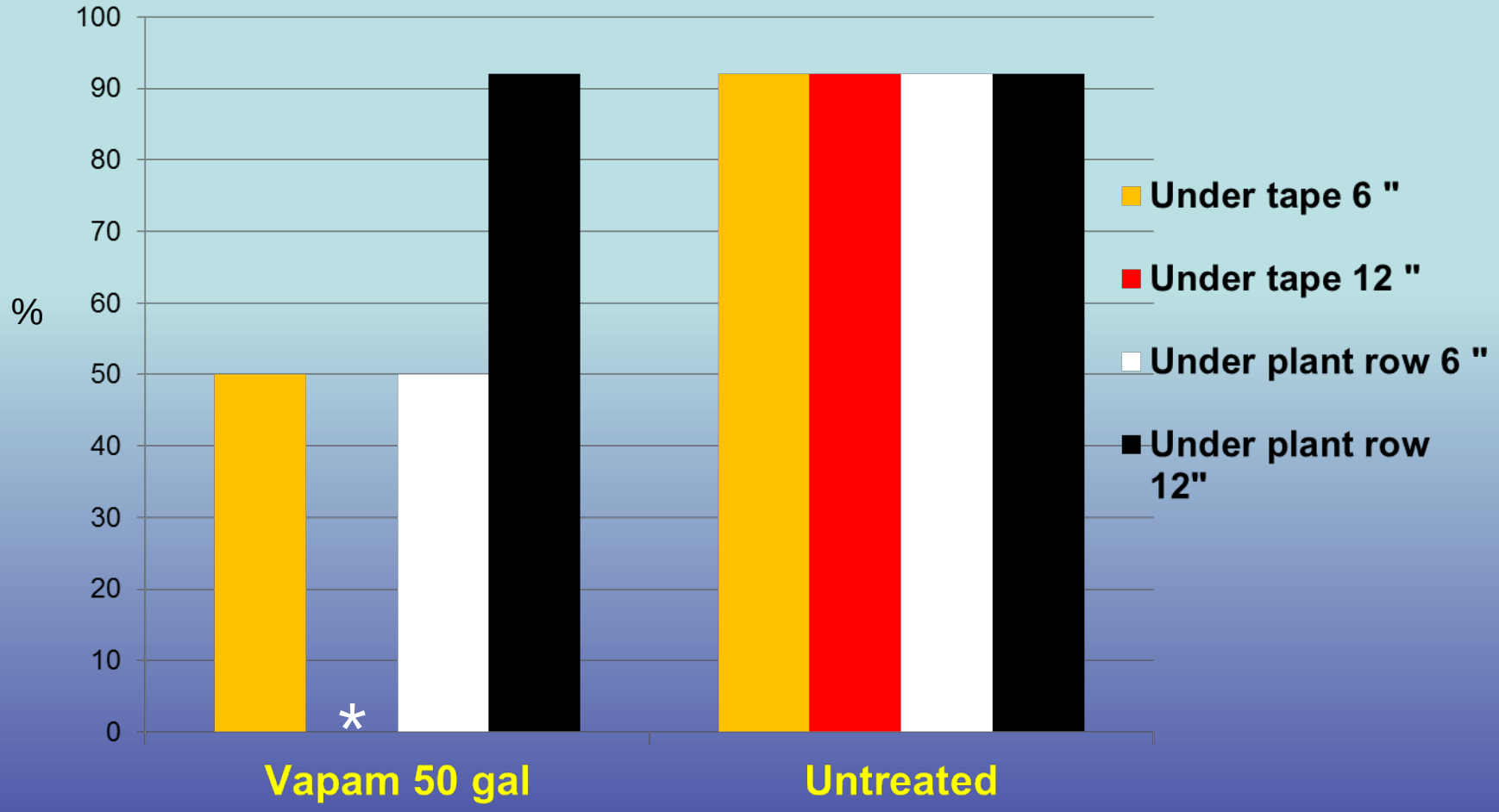
After VAPAM under the DRIP LINES

What about Fusarium?

F. oxysporum in sand inoculum

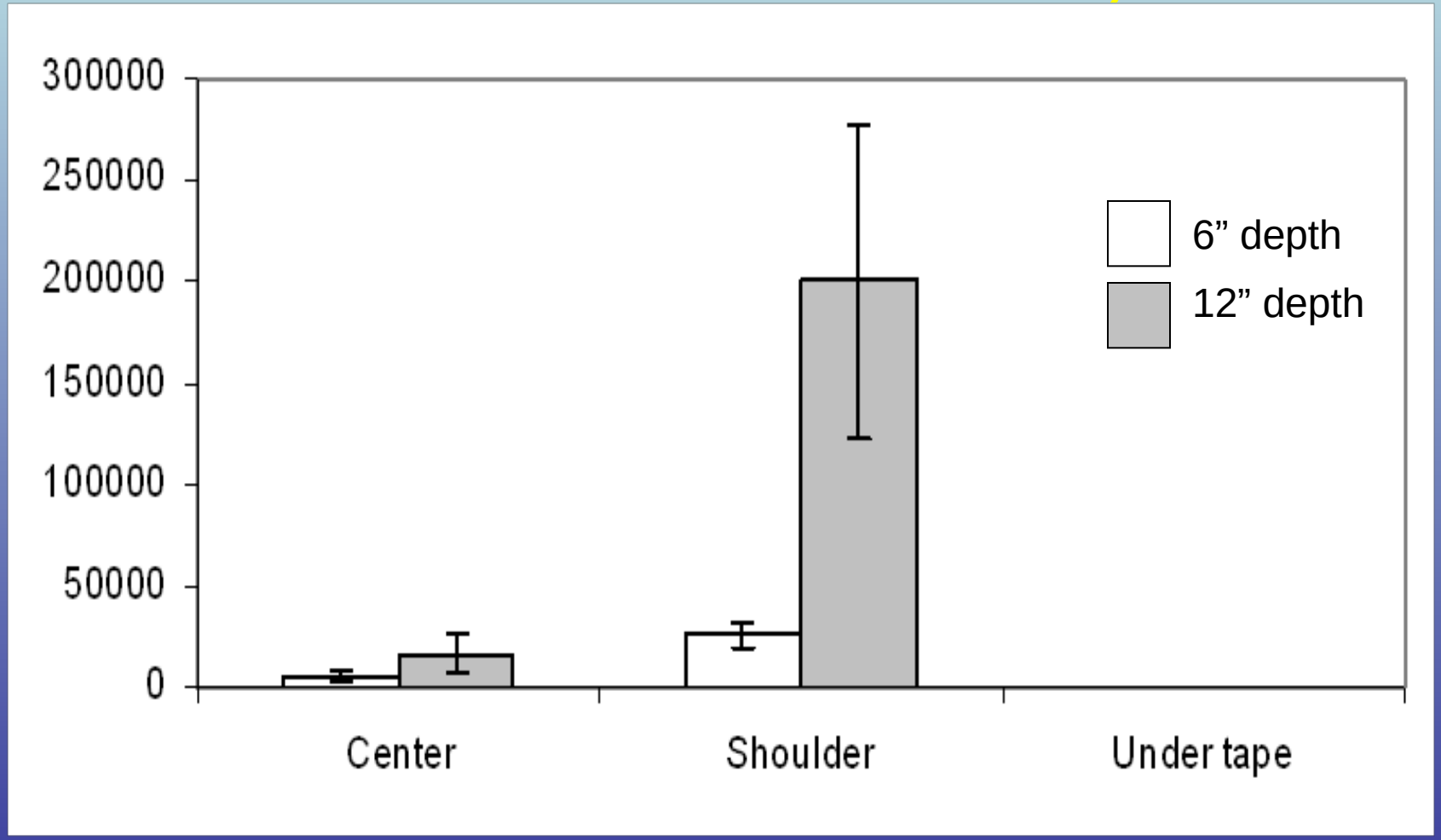


Recovery of *F. oxysporum* from infested crowns



Pathogen Survival at depths 12” +

DRIP-FUMIGATED with Pic lor 60, 300lbs/a



At what depth do roots become infected?

In an infested buffer zone we replaced soil with fumigated soil :

0-6”, 0-12” 0-16”

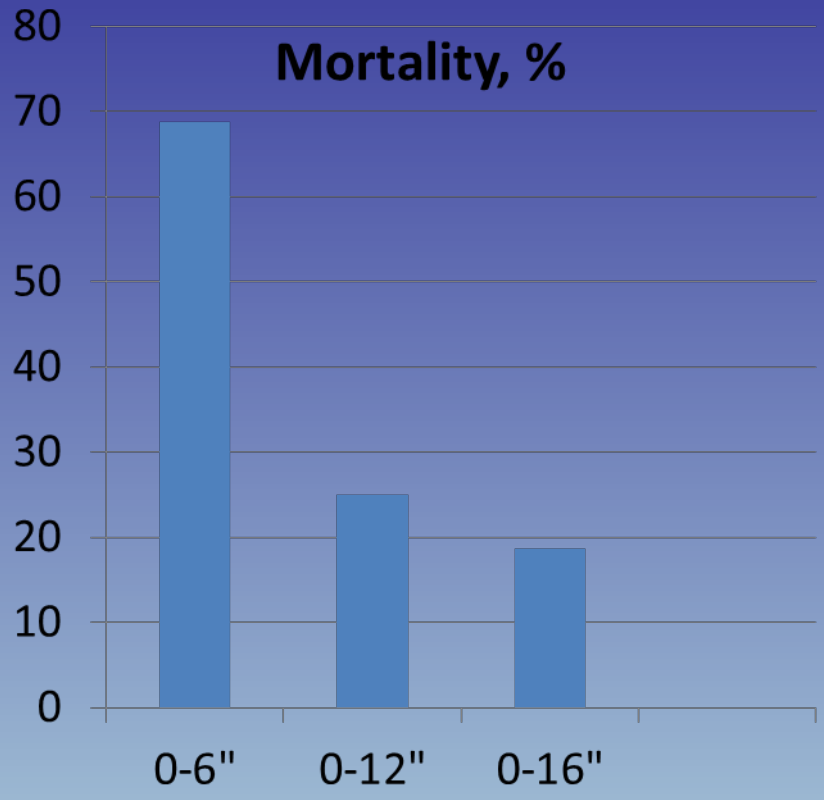
April 16, 2013

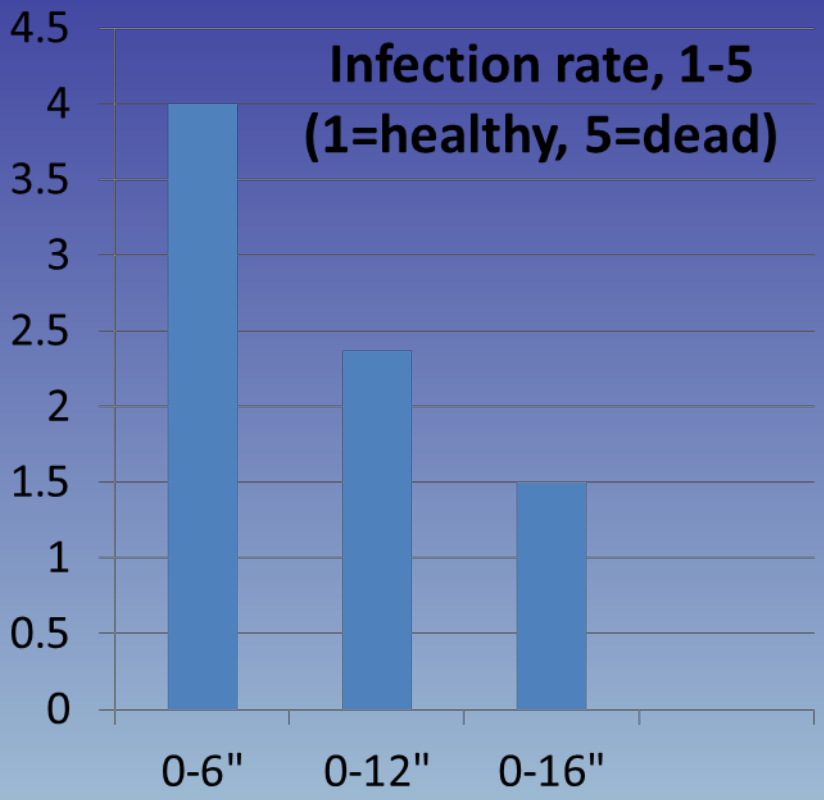
Planted in replaced fumigated soil 0-16”

April 16, 2013

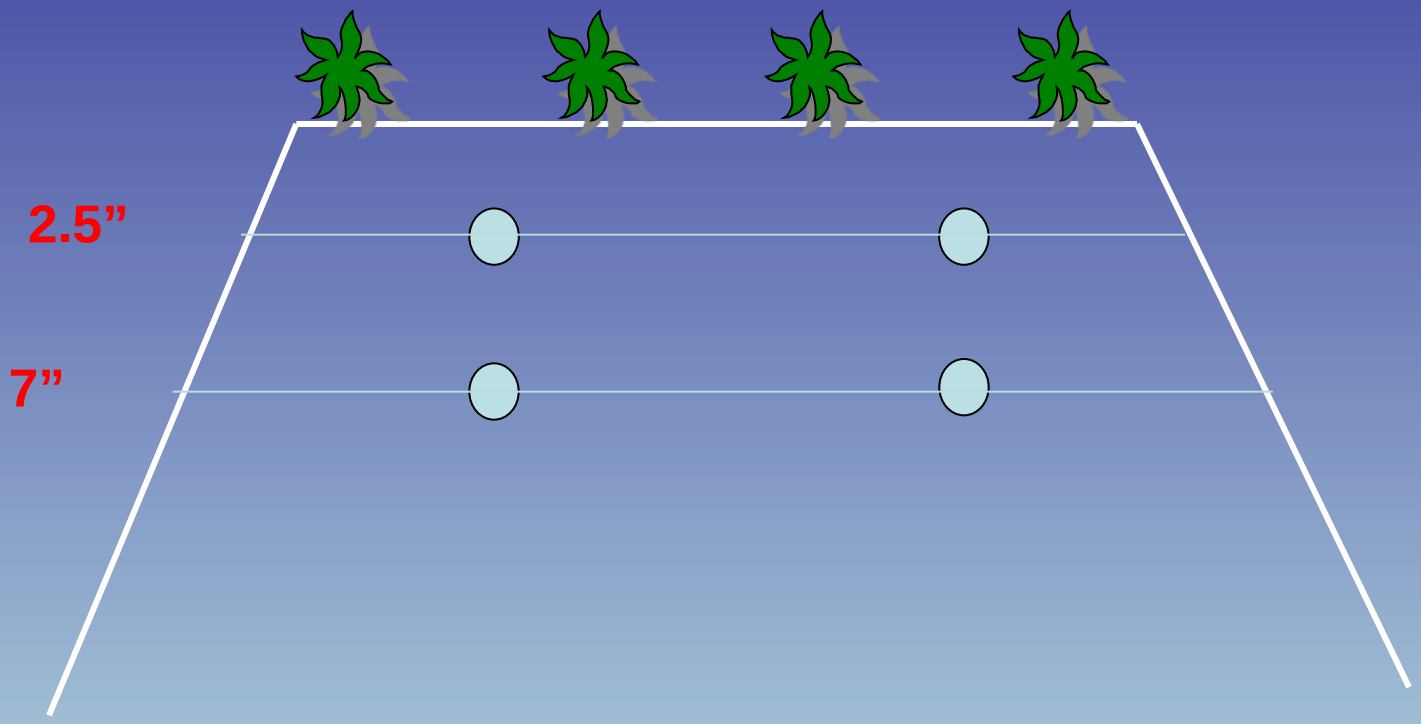
Planted in replaced fumigated soil 0-6”

Replacement of soil in infested buffer zone with fumigated soil to 3 depths. May 5, 2013





CAN WE FUMIGATWED DEEPER WITH 2 additional ‘deep’ drip lines?



Treatments

1) Untreated - 2 lines under TIF w/o fumigation
2) Two shallow drip lines – full rate under PE
3) Two shallow drip lines - full rate under TIF
4) Two shallow drip lines - 1/2 rate under TIF
5) Four drip lines (2 shallow & 2 deep) - full rate under TIF
6) Four drip lines (2 shallow & 2 deep) - 1/2 rate under TIF

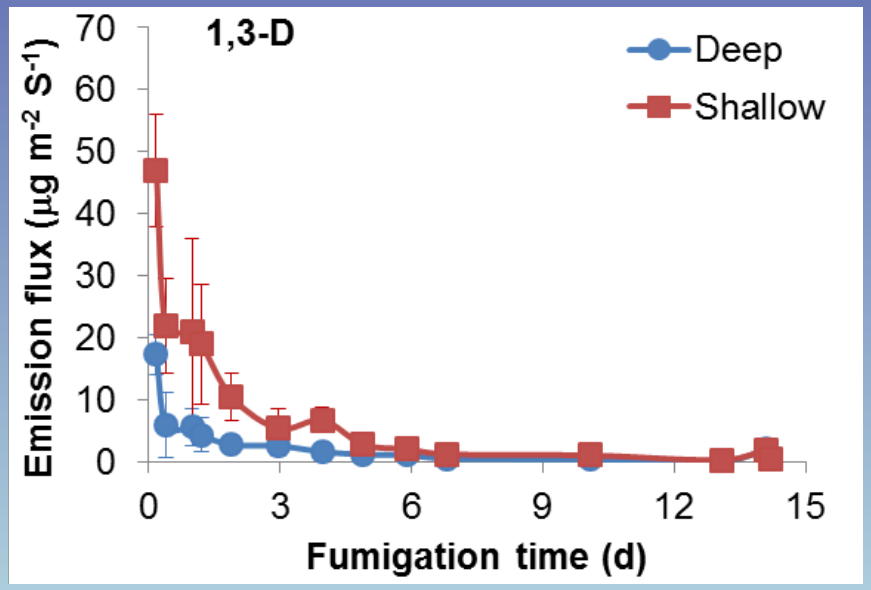
Pic-Clor 60 EC 300 lbs/ac vs. 150 lbs/ac (1/2 rate); a mixture of 56.7% CP, 37.1% 1,3-D, and 6.2% inert.

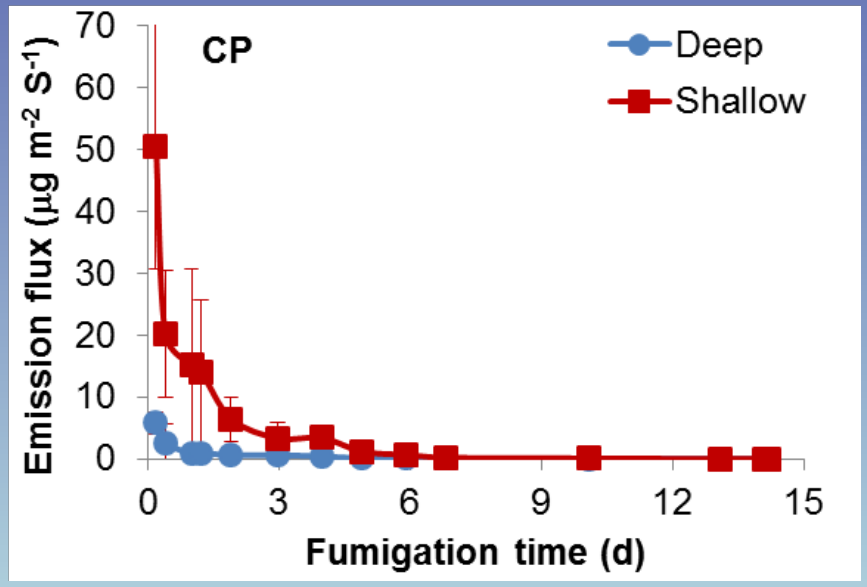
Measurements

- During fumigation period (Aug. 16-Aug. 30):
  - **Emission (passive chamber): Full rate TIF treatments (bed and furrow).**
  - **Fumigant concentration under film above soil surface (AU).**
  - **Fumigant gas in soil profile.**
  - **Pathogen survival at the end of fumigation.**
- **After fumigation:**
  - **Plant performance and fruit yield**

Fumigant emissions from bed

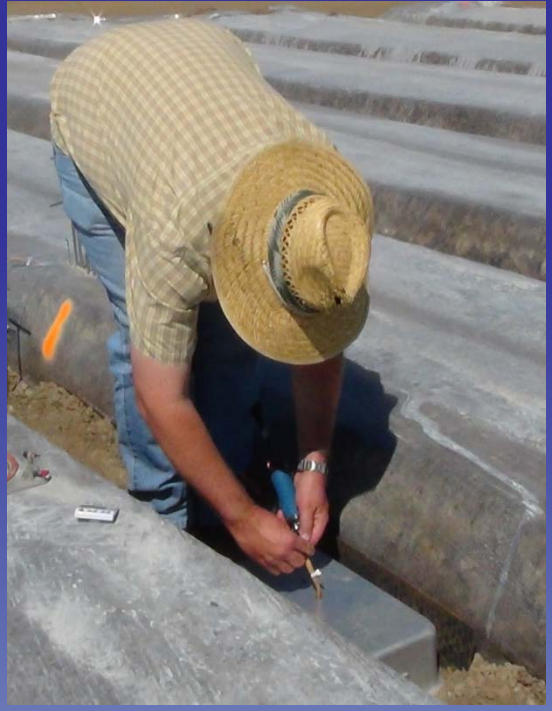
Deep vs. shallow application:

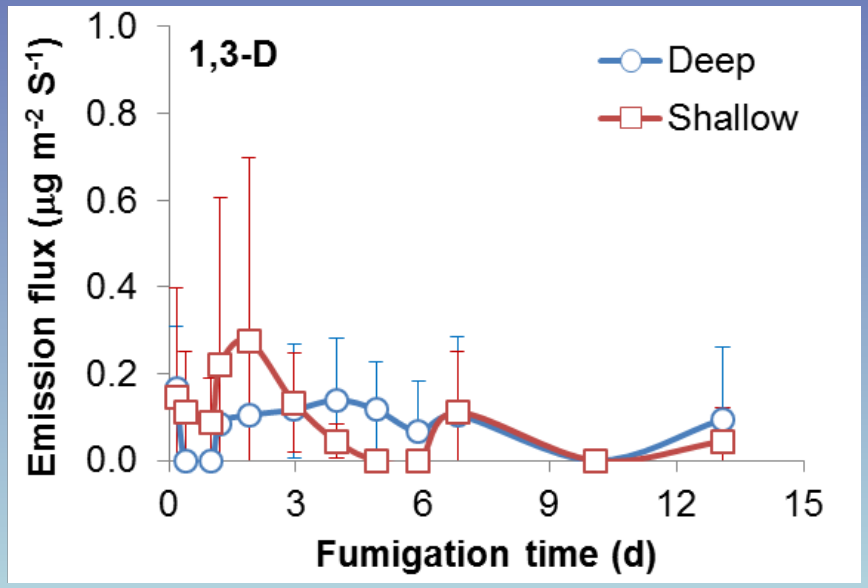


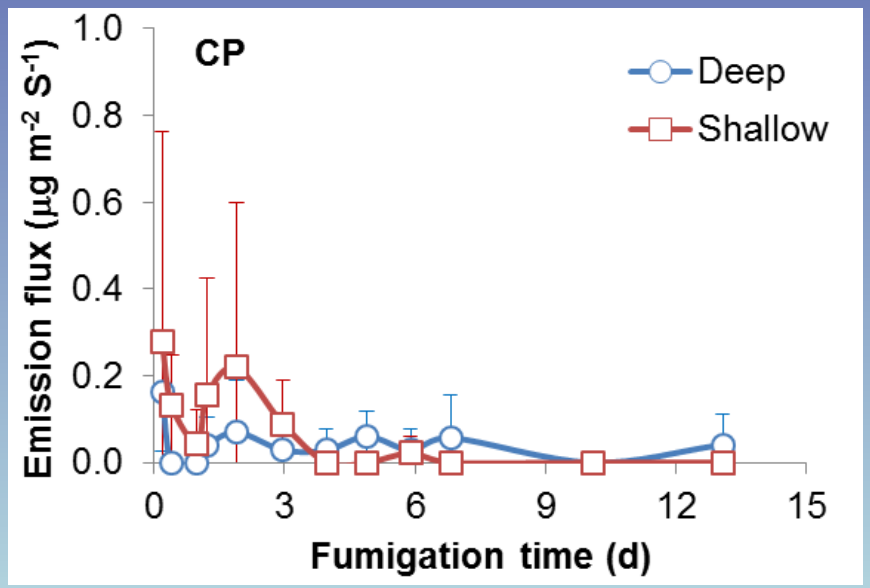


Fumigant emission from furrow

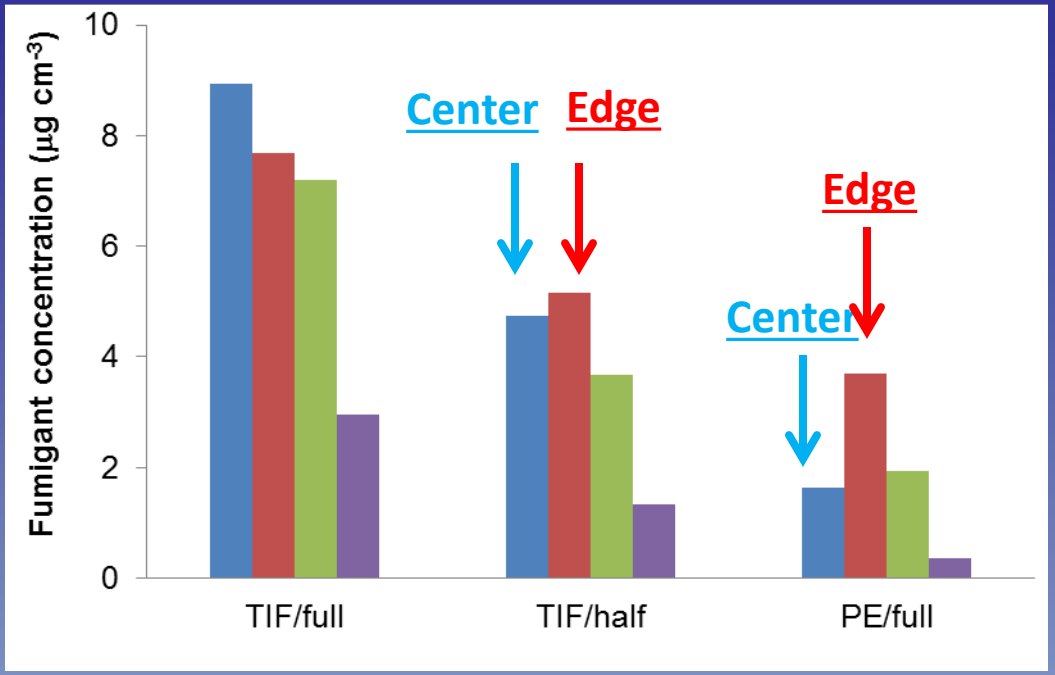
Deep- vs. shallow-application:

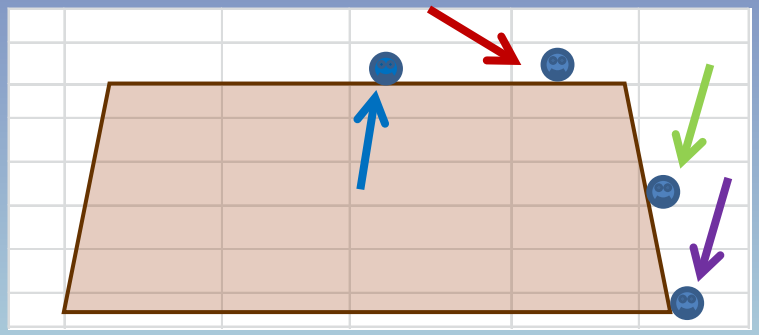




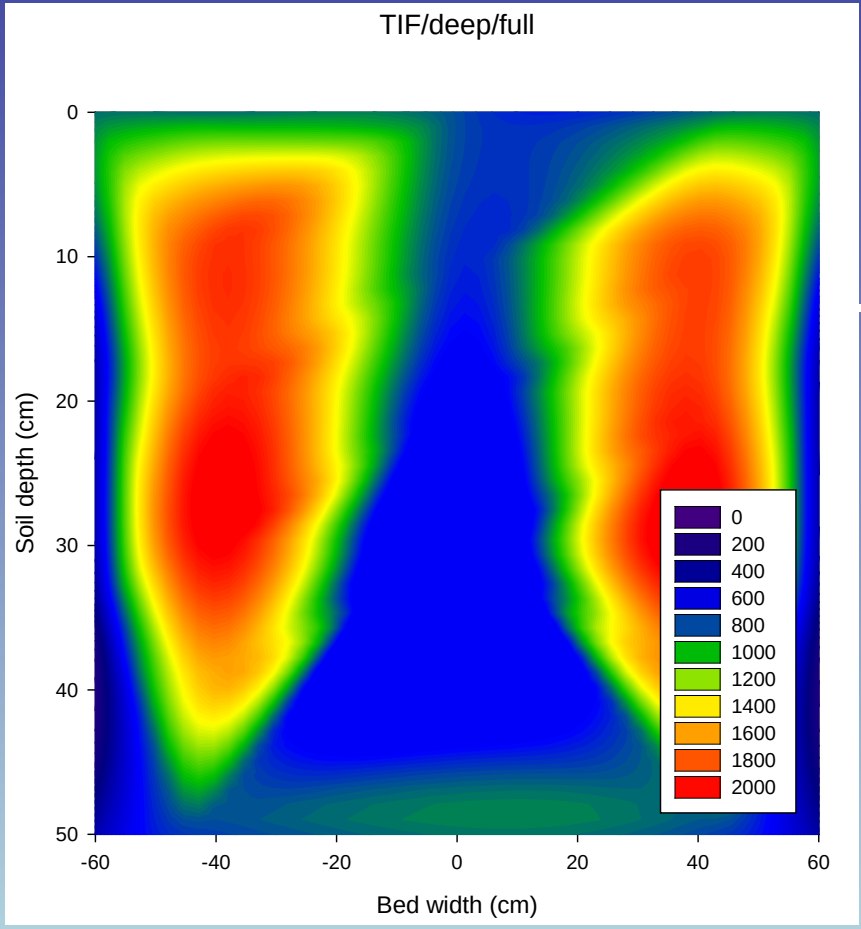


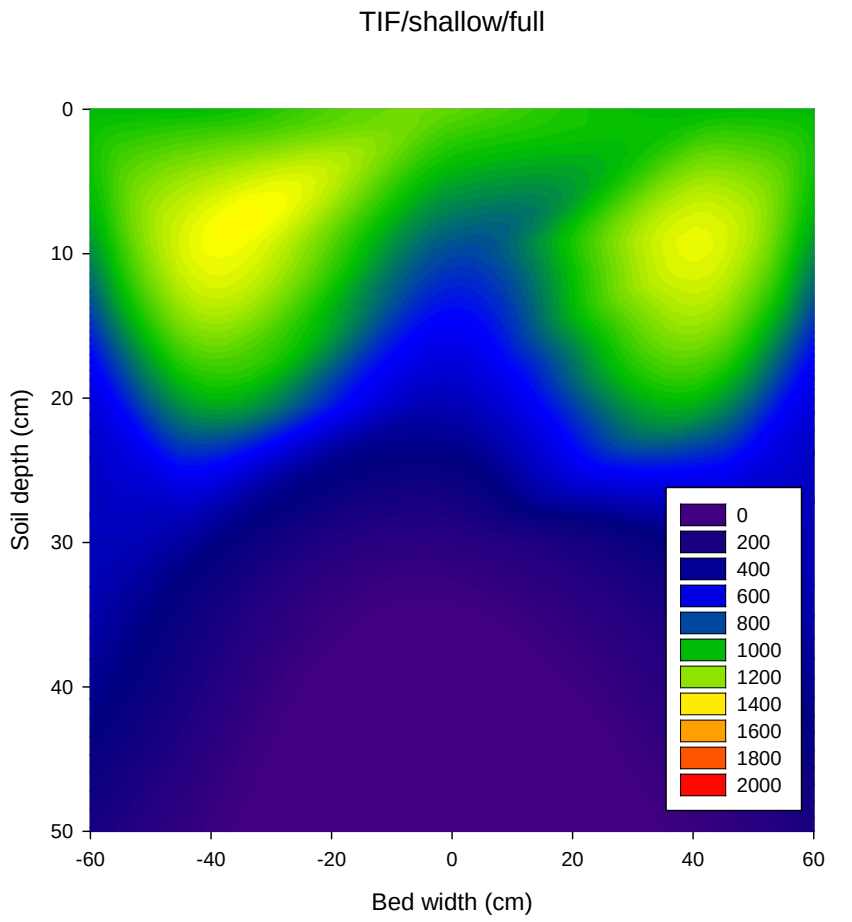
Fumigant concentration under film





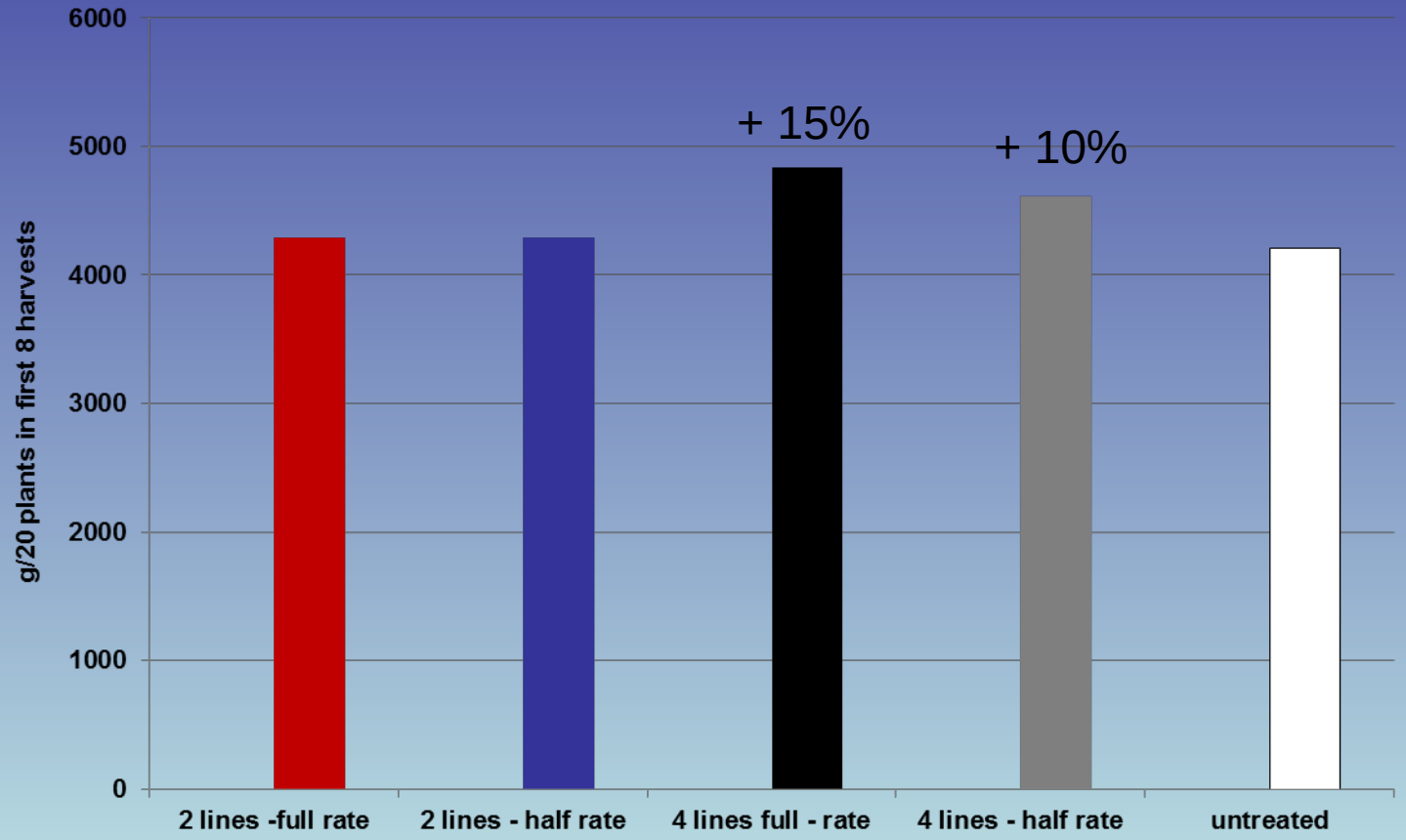
Fumigant concentration time exposure index





Marketable fruit yield

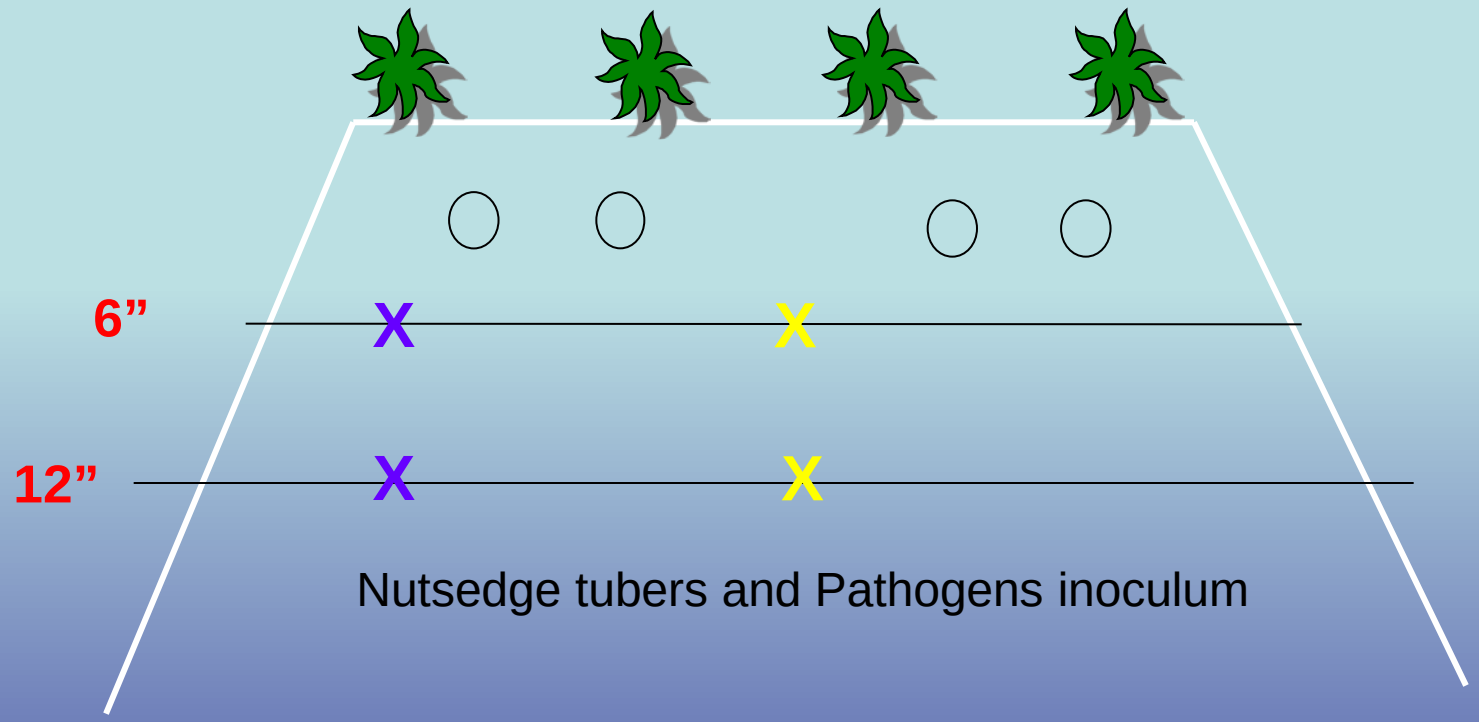
January 30 to March 18.



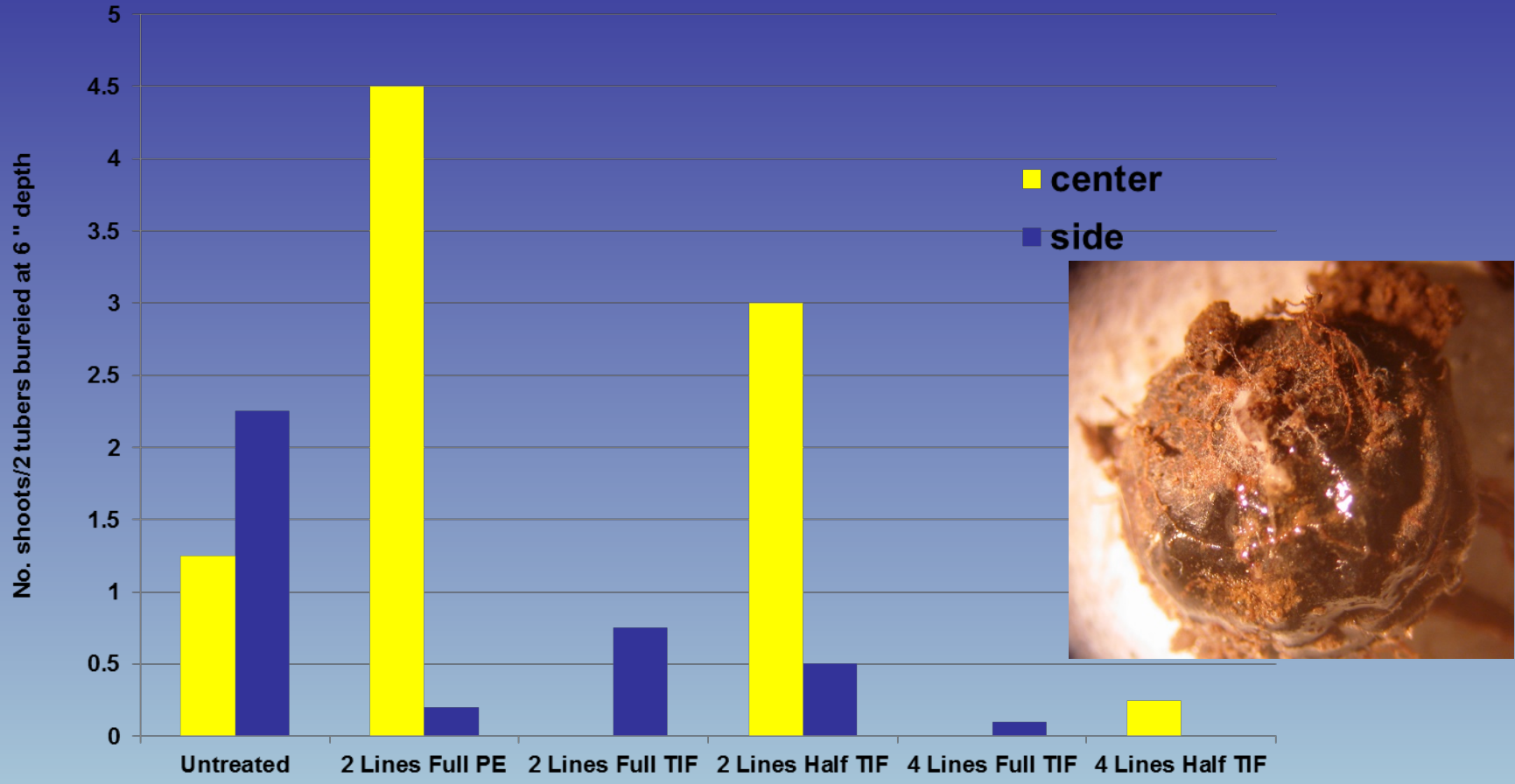
Questions on deep fumigation technique

- What's the best application depth?
- How to improve fumigant distribution at bed center?
- **How to remove deep-buried tape at the end?**

Fumigation via 4 ‘shallow’ drip lines



Yellow nutsedge shoots after 150 lb Pic with various applications



What else can we do with Anaerobic Soil Disinfestation?

Oleg Daugovish, Anna Howell, Bill Rutan, Steve Koike (UC-ANR), Joji Muramoto and Carol Shennan (UCSC)

Effective ASD = C-source + water + plastic mulch

- Need C-source uniformly mixed
- Standard LDPE mulch – sufficient
- Black mulch as good as clear
- 3 inches of water - sufficient
- 3 weeks duration in summer

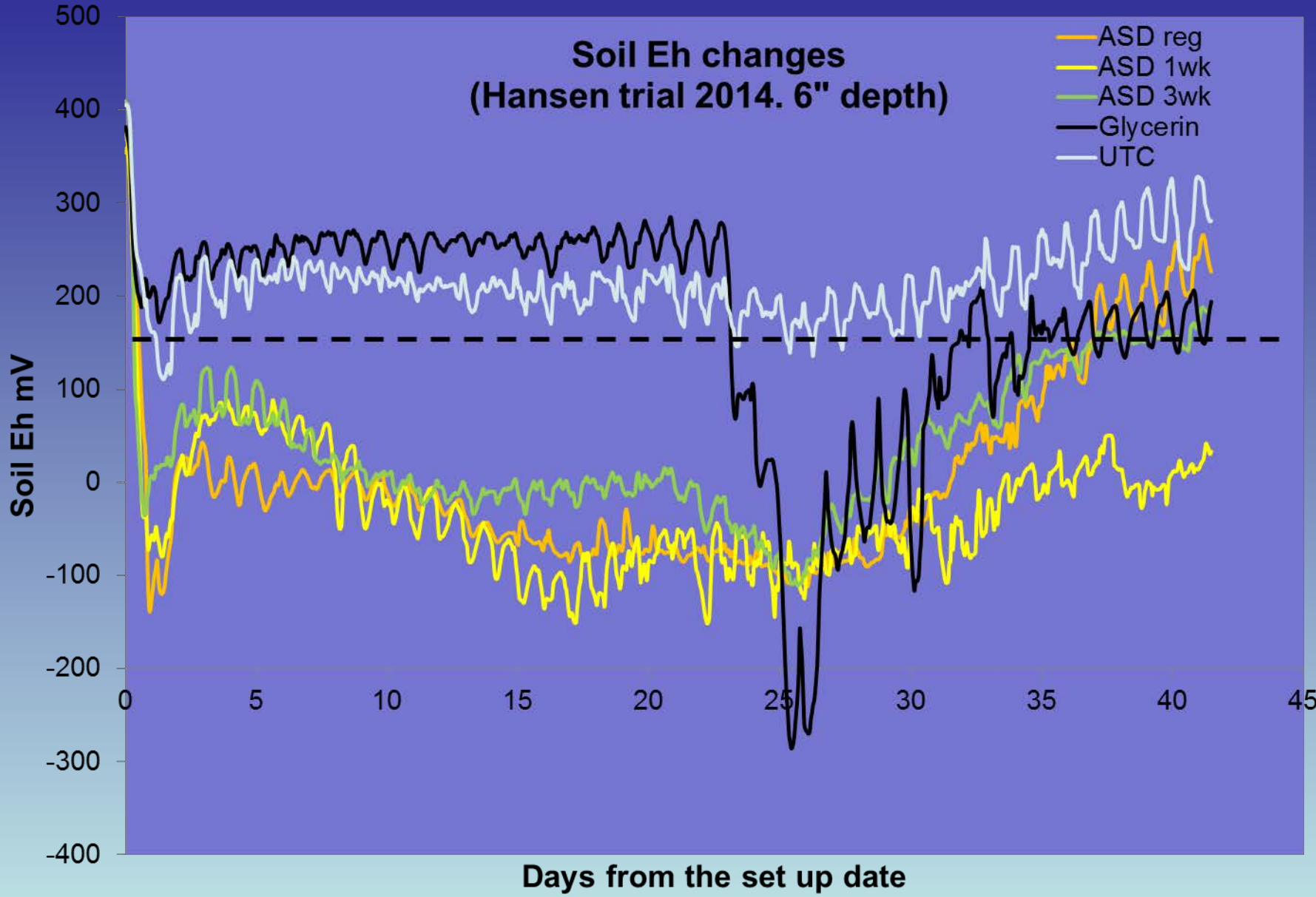
For C-source:

- Rice bran applied to beds: at least 25% less needed
- Apply Glycerin at 4% by volume via drip

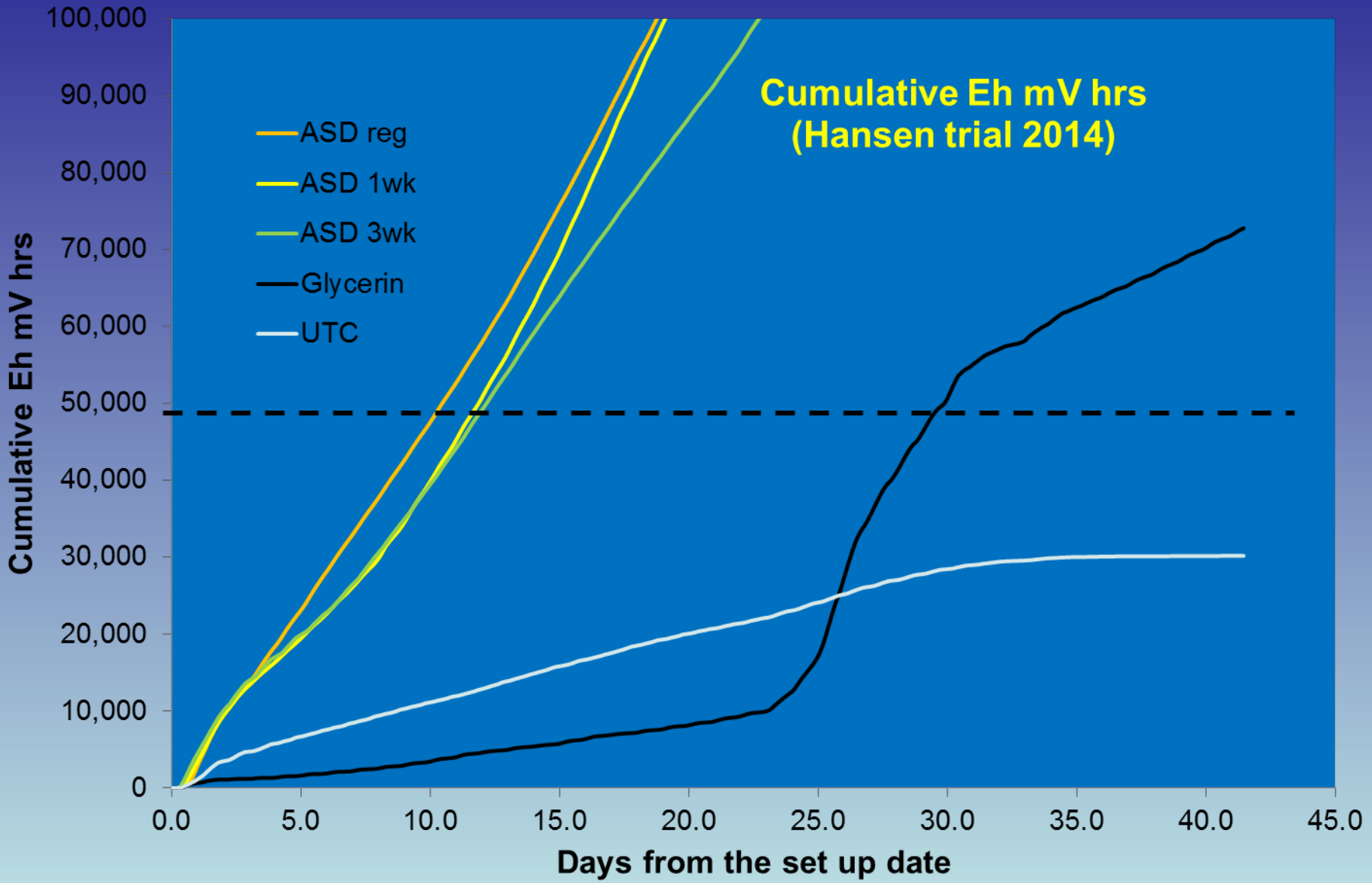
For water:

- Delay drip irrigation 1 wk after bedding
- Apply no water after bedding
- Drip-irrigate immediately

Anaerobic conditions



Anaerobic conditions



No effective herbicides for nutsedge control in strawberry?

Oleg Daugovish, Anna Howell, Bill Rutan, UCCE-Ventura
and Steve Fennimore and Tom Gordon, UC-Davis.

No effective fumigants after MB and MI are out

S-metolachlor (Dual Magnum)

- Good nutsedge efficacy and safety in vegetable crops
- Added to IR-4 (minor crop) list for strawberry:

  Supporting data on nutsedge control in strawberry and crop safety

Yellow and purple nutsedge at Santa Paula, CA in summer-planted strawberry, 2009

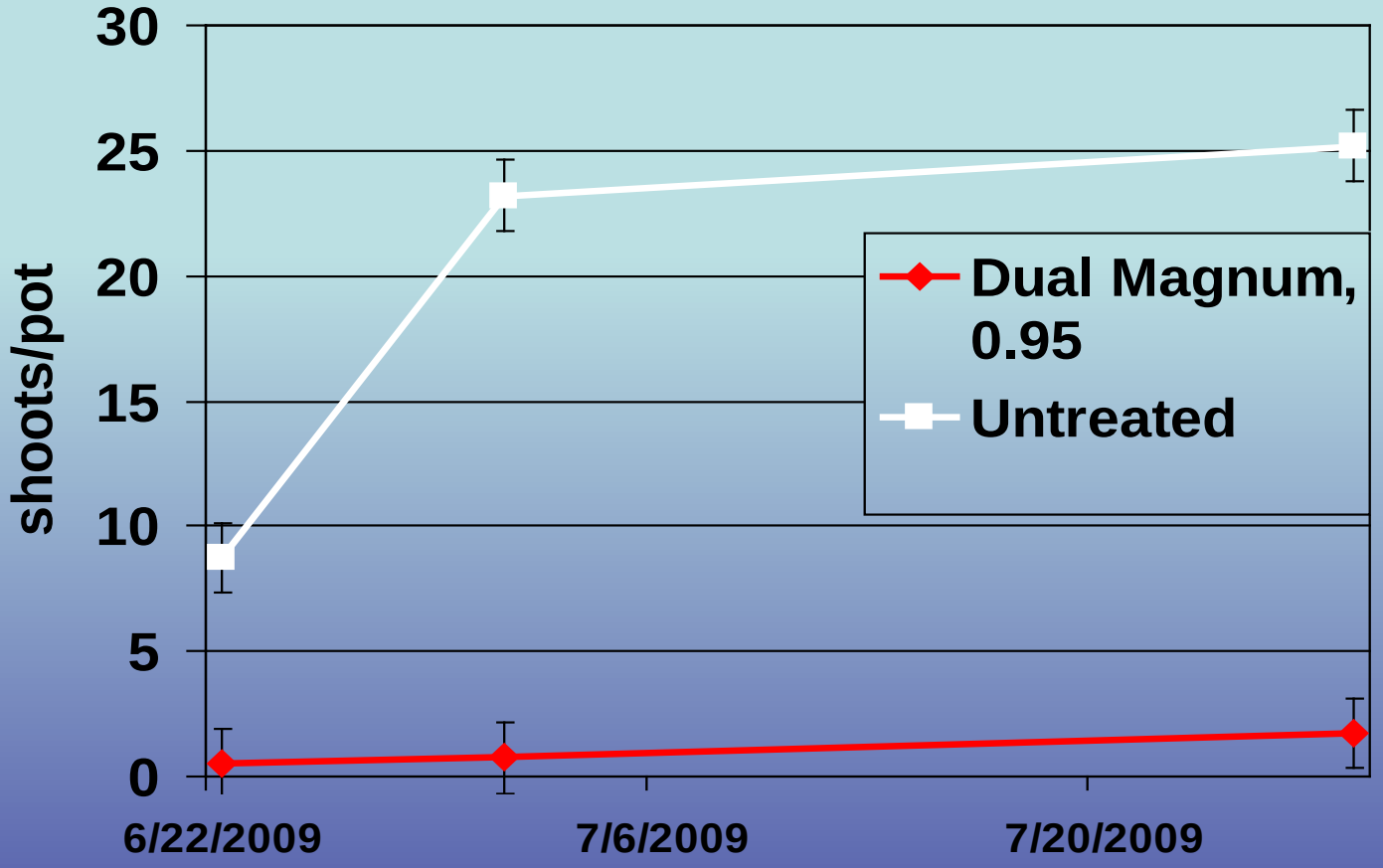
- Nutsedge tubers placed in pots into beds
- DM 0.95 lb a. i. /acre on June 9
- Applied to beds and covered by mulch
- Strawberry transplanted 30 d later

Purple nutsedge

Untreated control

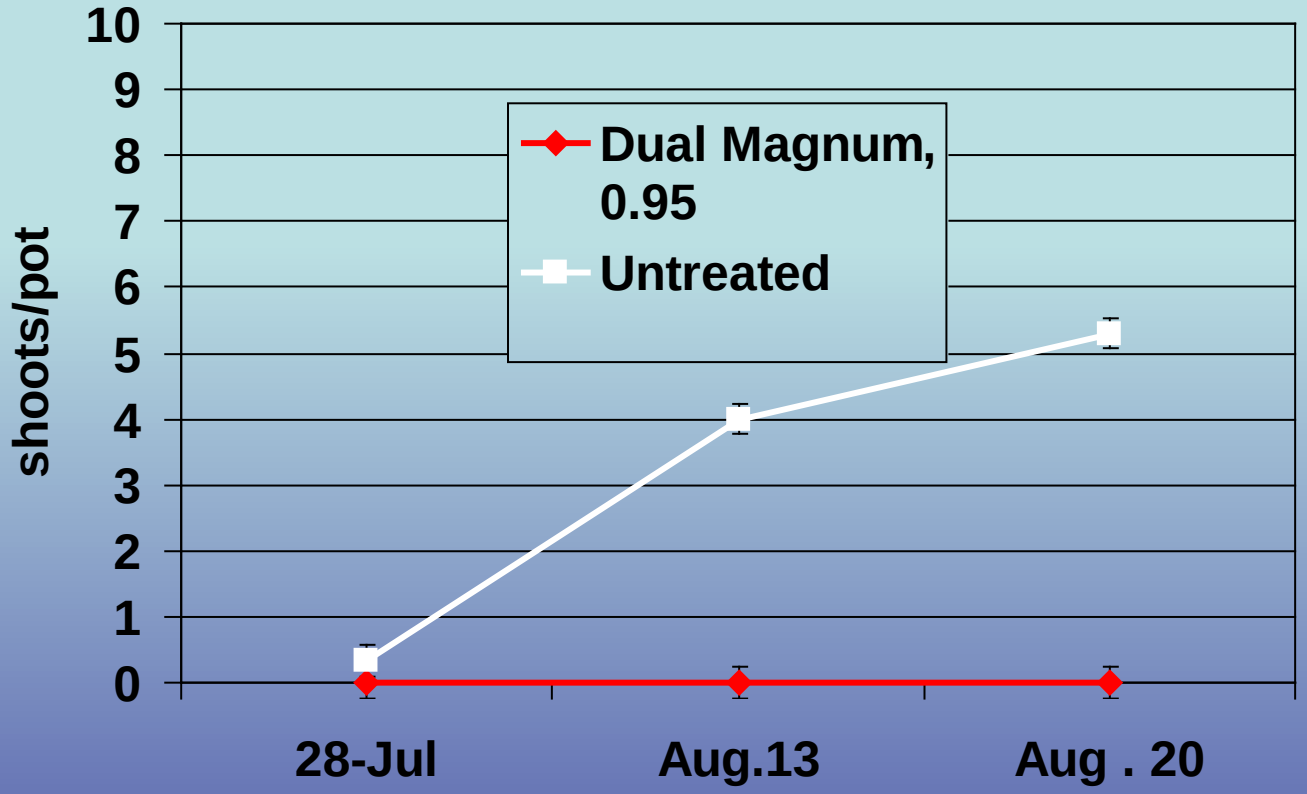
DM 0.95lb a. i./acre

Purple nutsedge counts



No significant injury to strawberry

Yellow nutsedge counts



injury was not determined : poor quality transplants

March 19, 2010: yellow nutsedge re-emergence in untreated

DM 0.95

Untreated

2010:
Nov 22

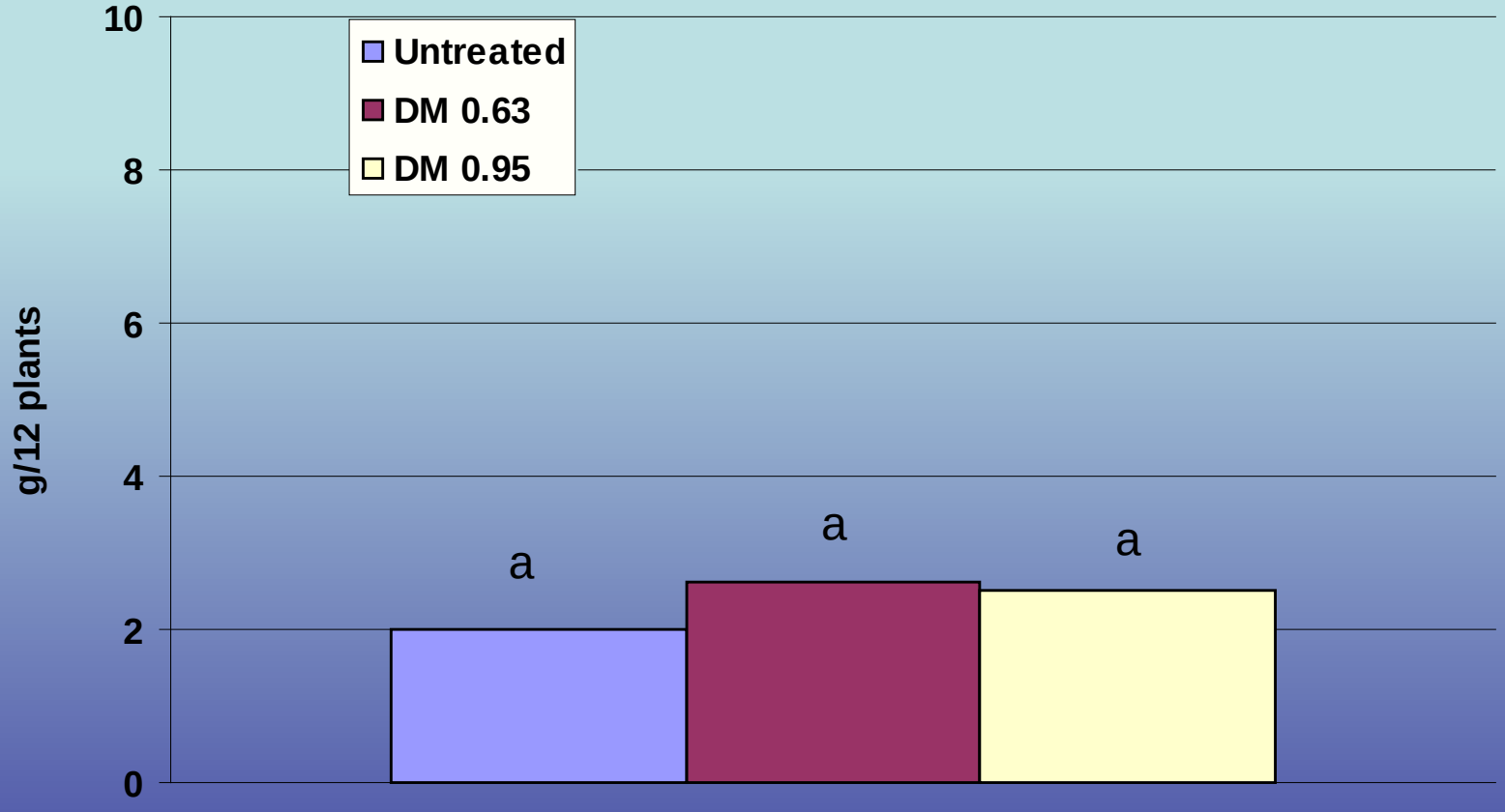
DM 0.63

DM 0.95

Untreated

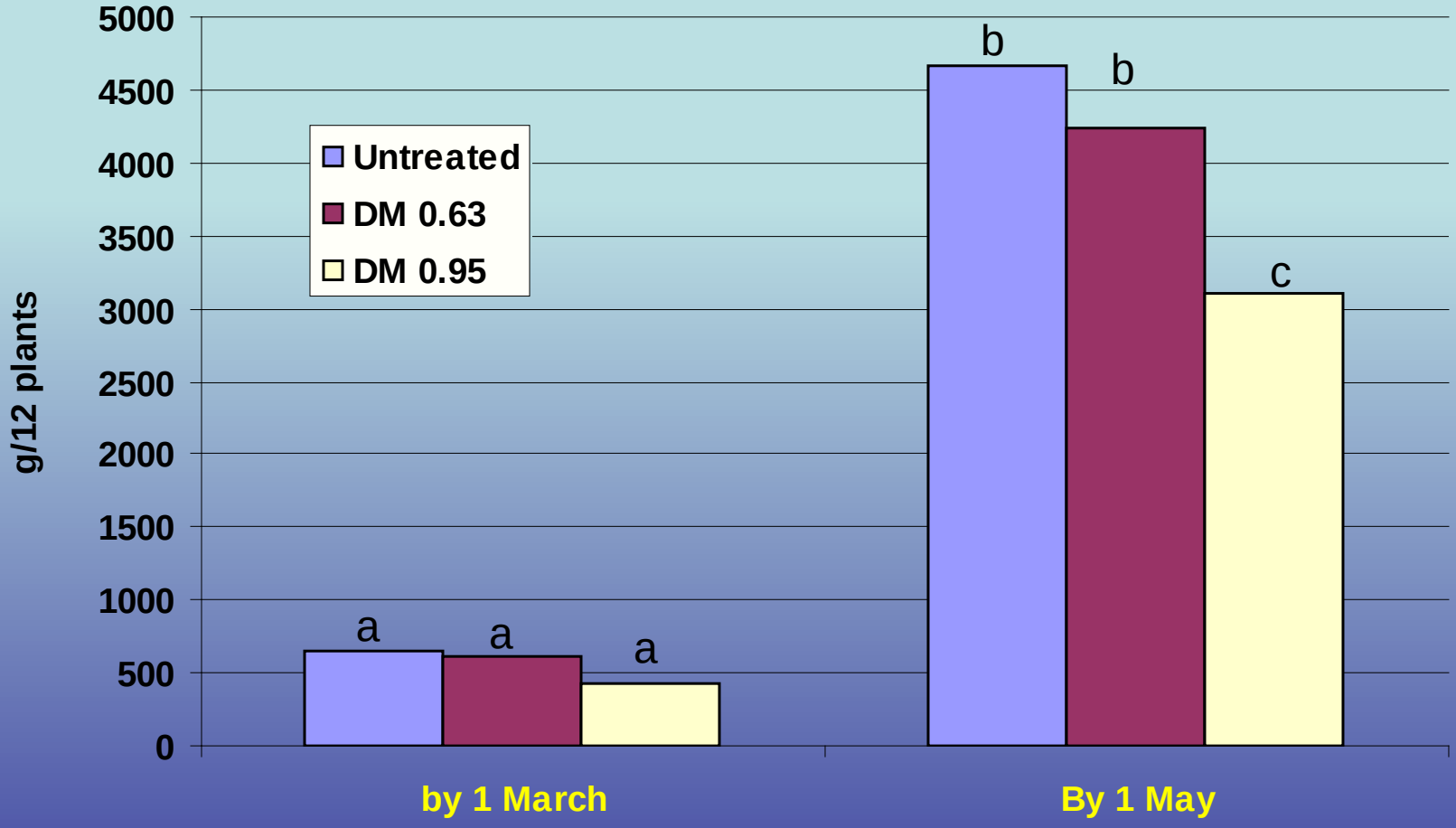
2010

Injury (1=none to 10 =dead)



Mortality: identical in all treatments ~1.5%

Marketable fruit yield, 2011



Unmarketable yield: similar trend

2013:
Look at lower rates

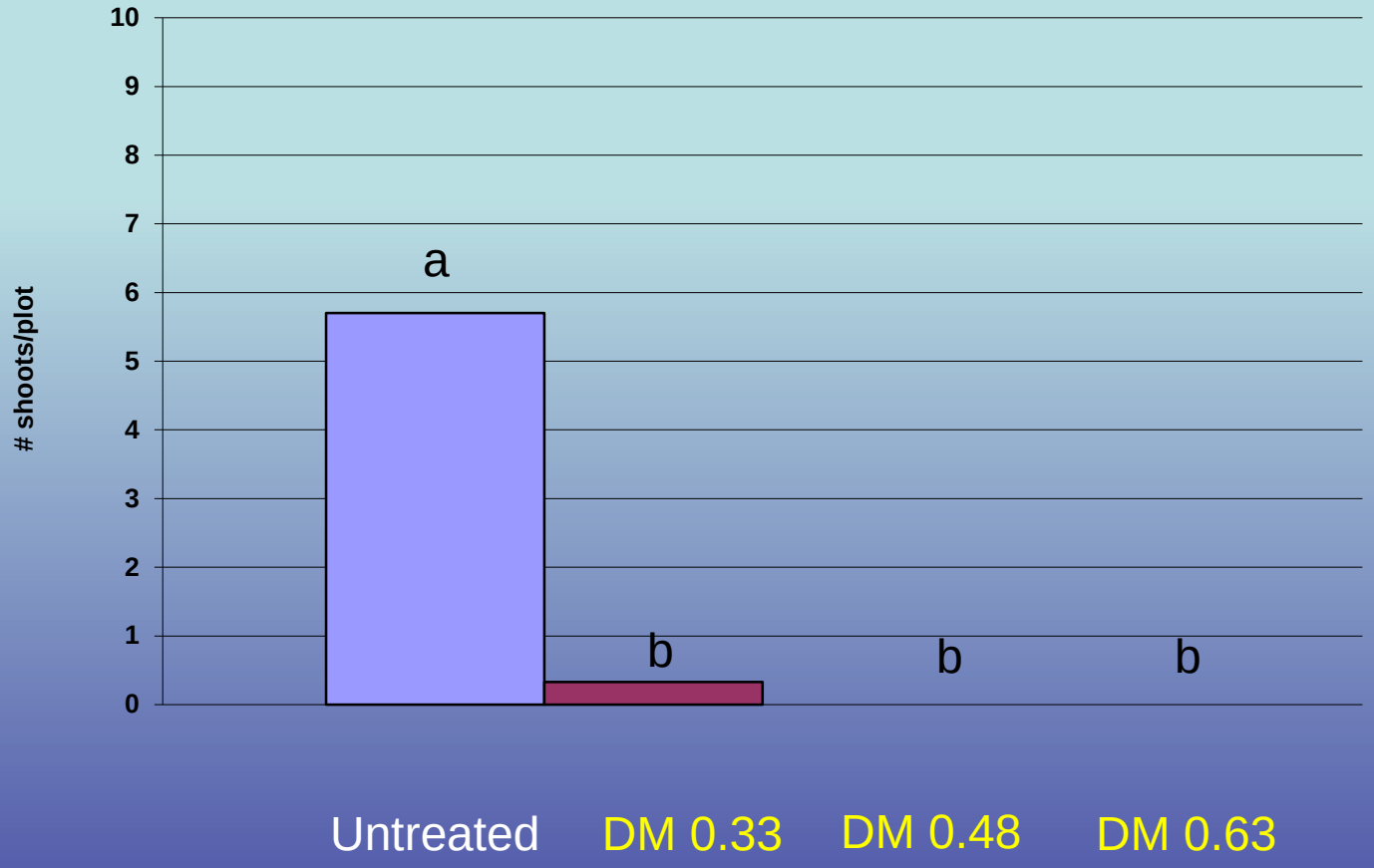
DM 0.33

Untreated

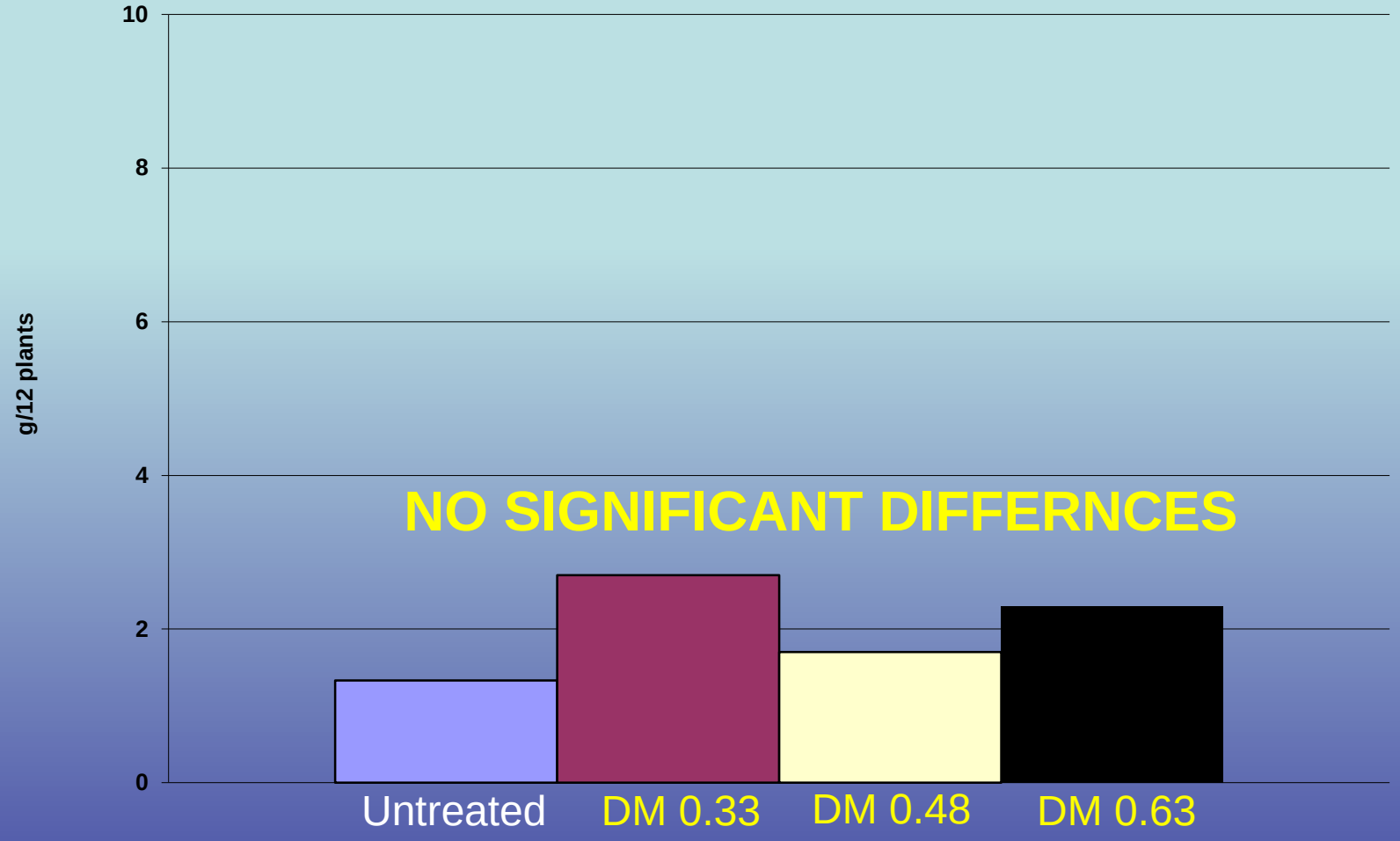
DM 0.48

DM 0.63

Yellow nutsedge shoots

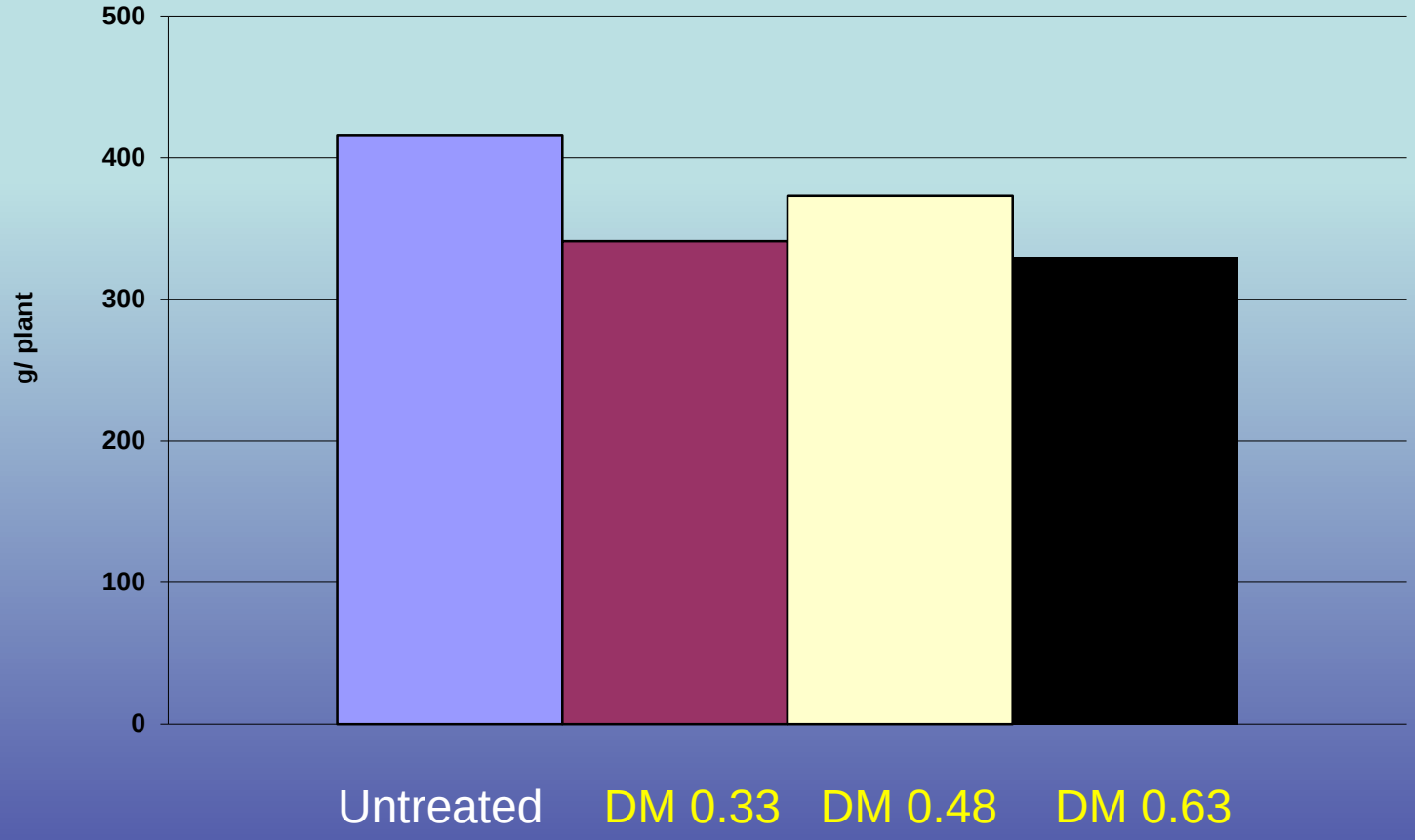


Injury (0=none to 10 =dead)



Mortality: identical in all treatments <2%

Fruit yield (first 4 harvests)



NO SIGNIFICANT DIFFERNCES

S-metolachlor (Dual Magnum)

- Use pattern: 30 d pre-plant to bed tops; Similar to our current herbicides and can be tank mixed
- Petition submitted to EPA in Feb 2014.

If crops are grown on plastic mulch, the Dual Magnum pre-emergence application should be made before laying the plastic. Dual Magnum may also be applied as a row middle application after the laying of the plastic mulch.

- 30 d pre-harvest if applied to furrows
- Supplemental indemnified 24 C label (SLN), registrant expects 2015

S-metolachlor (Dual Magnum): rates

Application Timing	Crop Growth Stage	Rate (pt/A)[1]
Preplant[3]	Before transplanting	0.67 - 1.33 (0.64-1.27 lb ai/A)

Acknowledgements

- Will Doyle with DW Berry Farms, Steve Imoto with Solimar Farms and UC Hansen
- Wal-Mart grant via U. Ark. Nat Sustainable Strawberry program, USDA funding and Cal Strawberry Commission (support).

Feb 3-6 in Ventura:

- > 60 presentations on all strawberry topics
- 6-7 workshops/roundtables
- Tour of production and research
- US and International speakers
- Info and registration at: website: **http://www.nasga.org**