
Sothern California update on soil disinfestation methods

What's in our soils

<u>Documented</u> fields during last 8 years with:

***Fusarium oxysporum*: 16**

***Macrophomina phaseolina*: 11**

***Verticillium dahliae:* 5**

Phytophthora fragariae* *3

<u>Undocumented:</u> 30%? 60%? 100%?

- **'Minor' pathogens:**

cause 10-50% reduction in yield when soil is untreated

- **Yellow nutsedge: 25-30% of fields**

In both: winter and summer strawberries

Strawberry Planting Rotation Zones/APIs

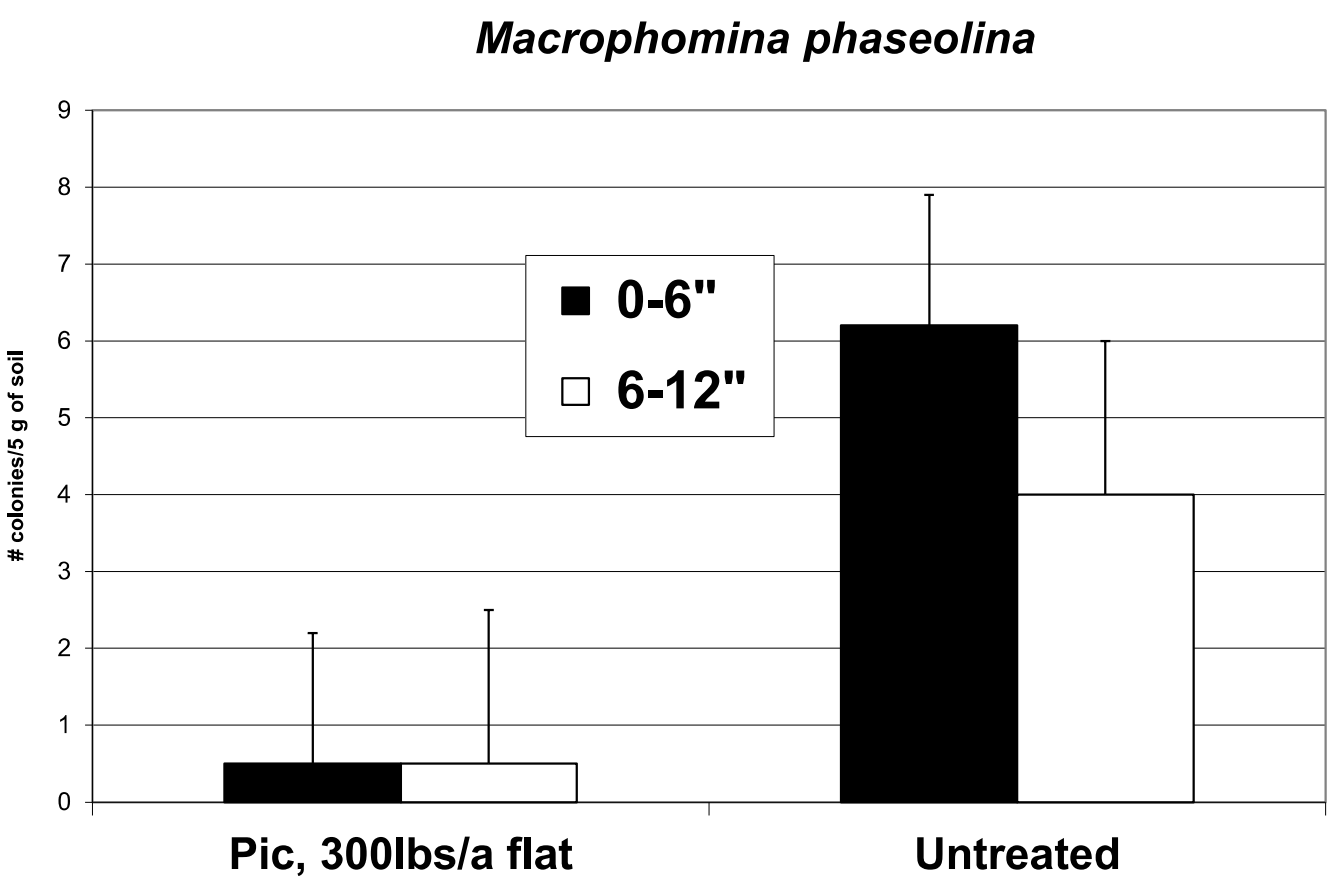
CONVENTIONAL PRODUCTION

FUMIGATION COSTS:

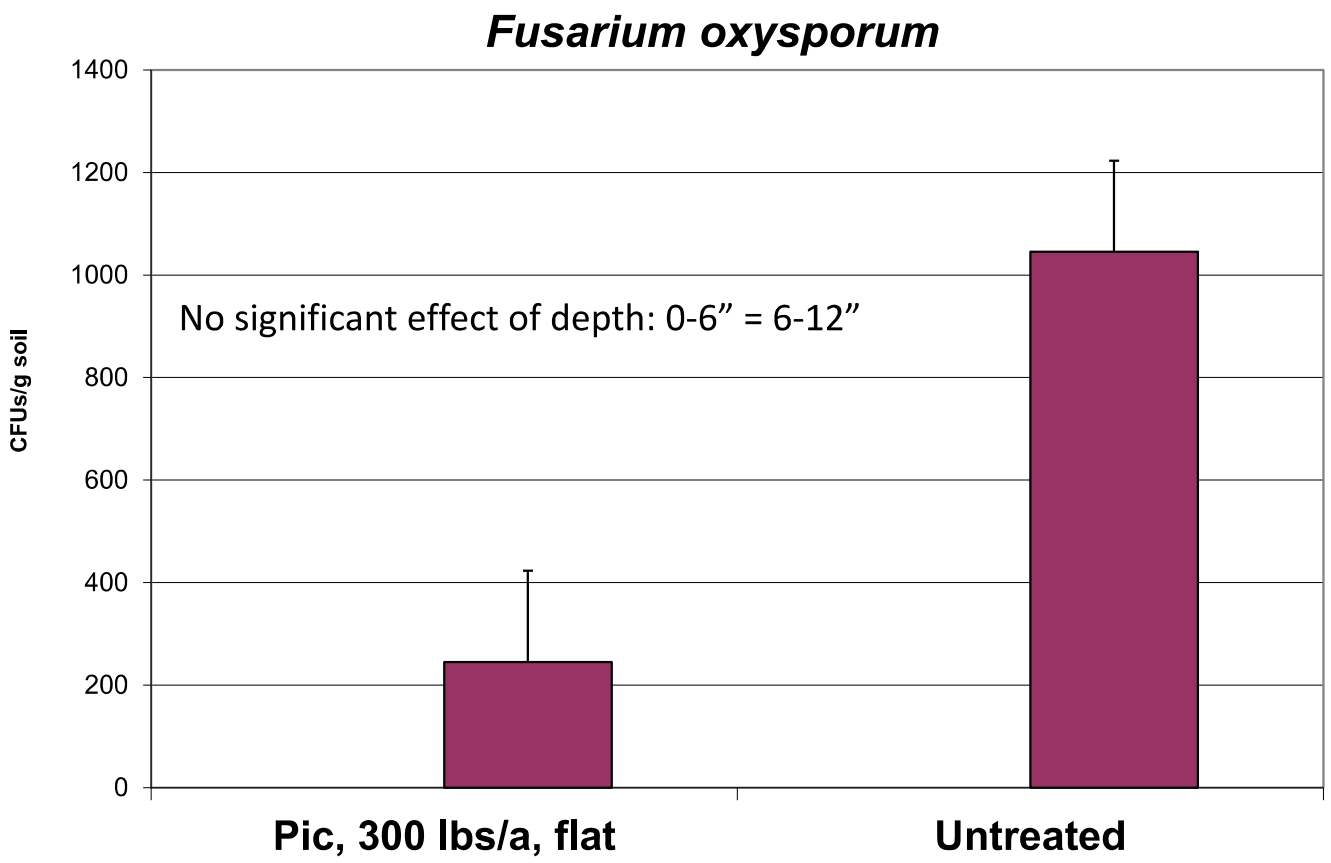
Flat fumigation = $3,000-3,700/Acre

Drip (bed) fumigation = $ 1,200-1,800/Acre (>70% of all fumigated acres)

BEFORE FUMIGATED Pic300

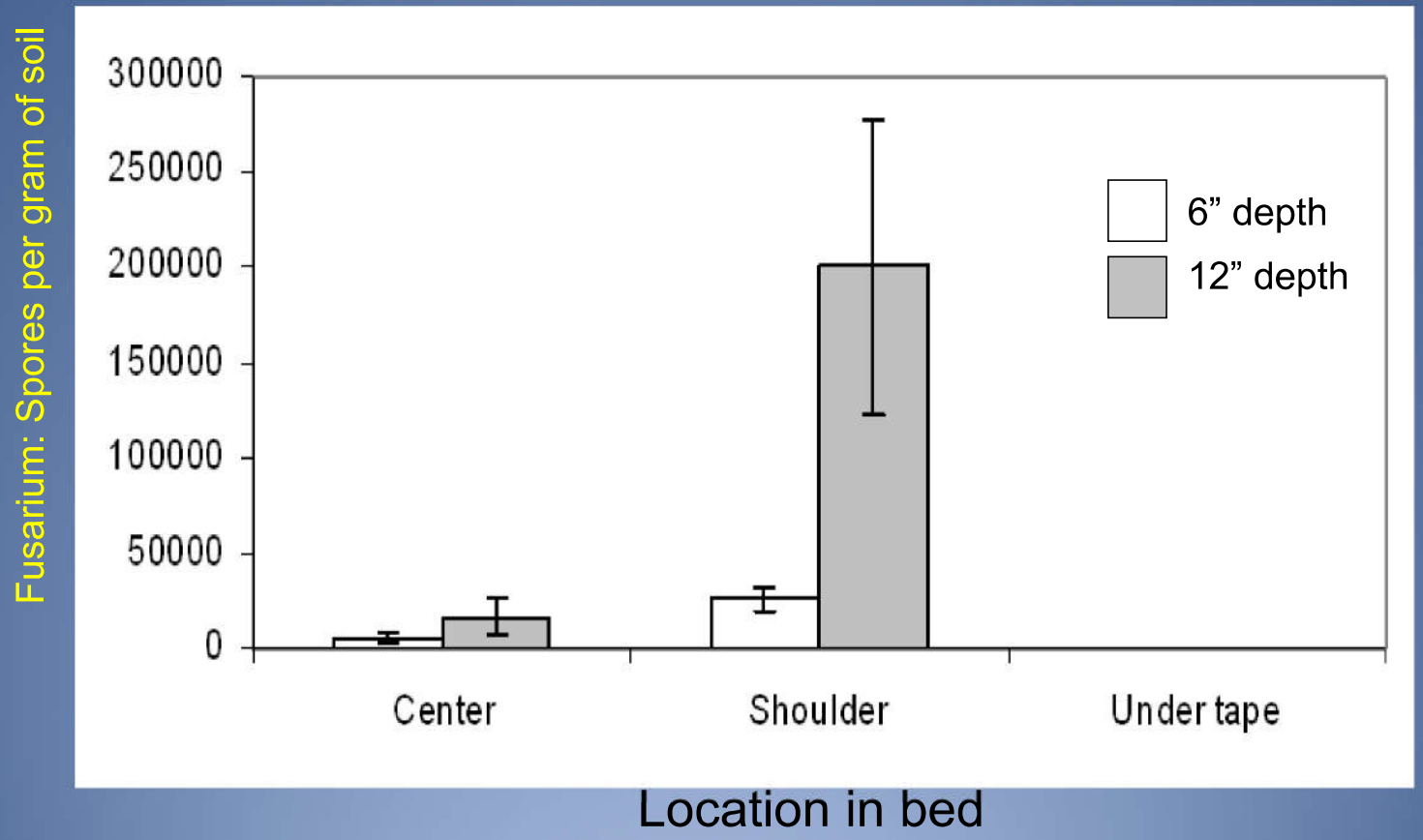


BEAT FUMIGATED: Pic300

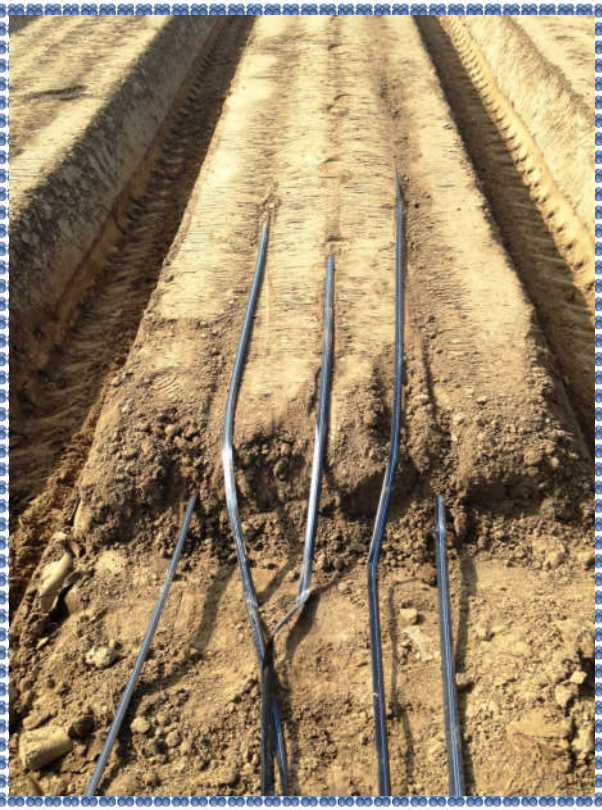


Effect of location in bed on fumigant efficacy

DRIP-FUMIGATED with Piclor 60, 300lbs/a

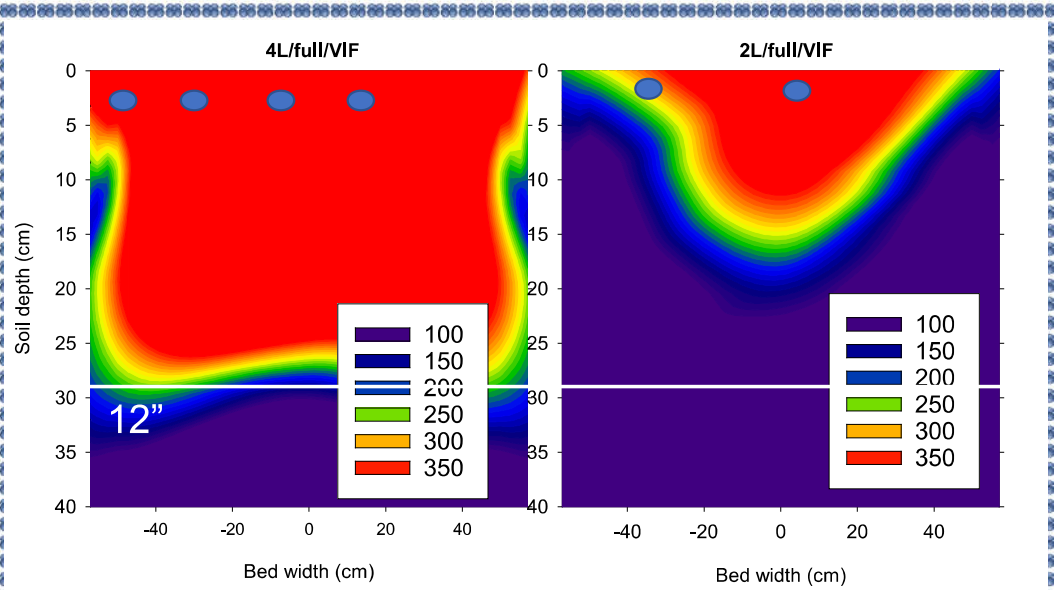


Adding lines for drip fumigation

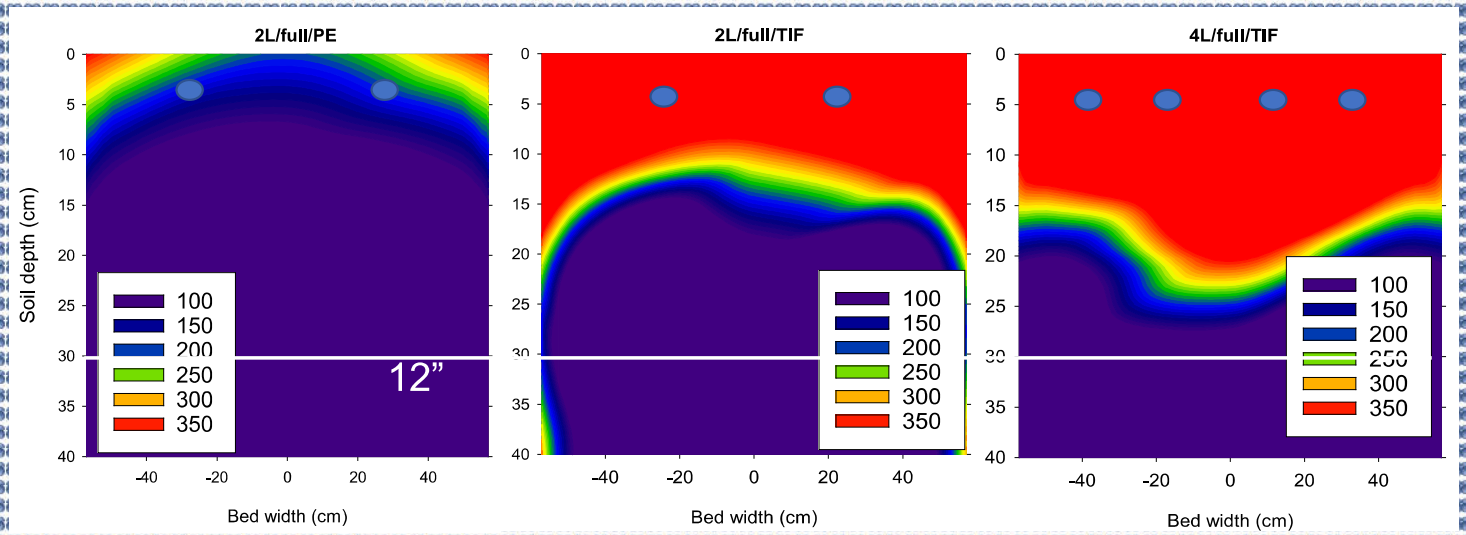


2014 Oxnard trial with Tri-Clor EC

Fumigants
24 hrs/ac



– CT value is accumulated (fumigant concentration * fumigation time)

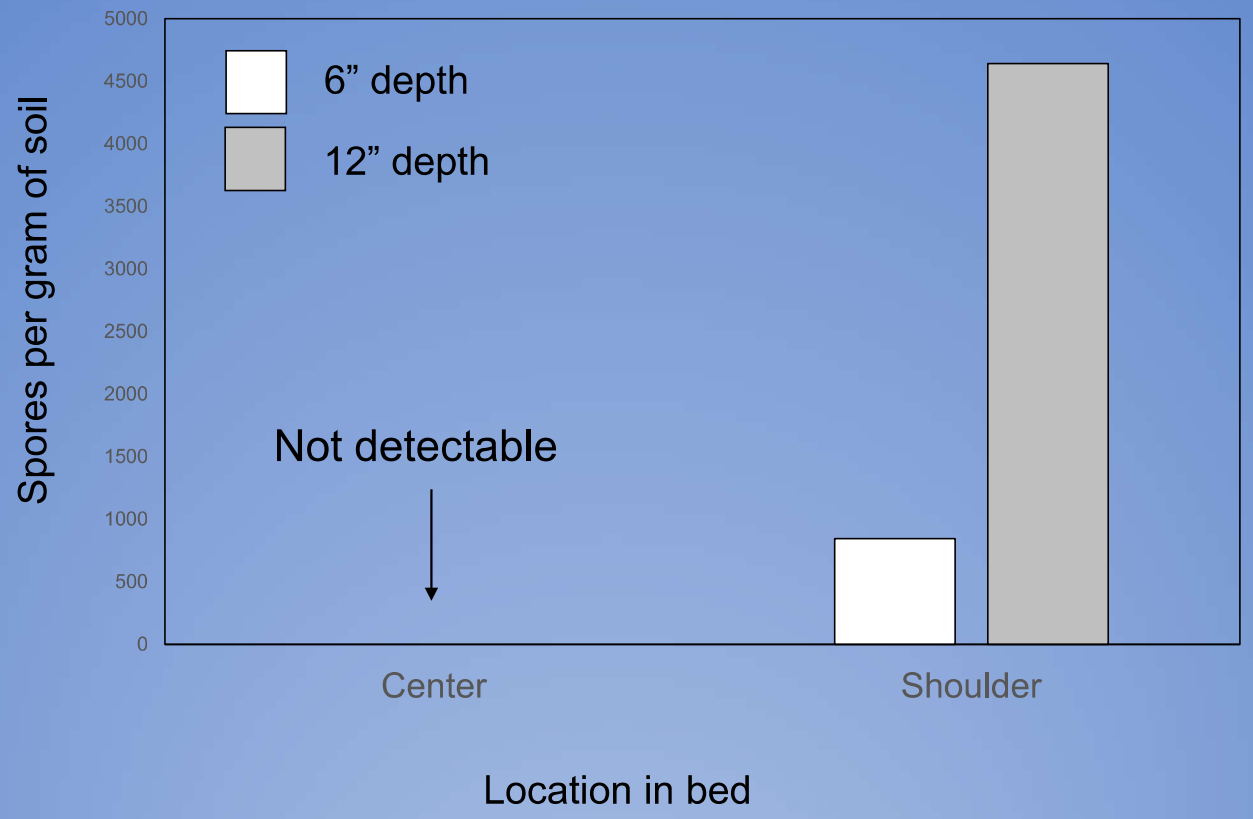


2015 Oxnard trial with Tri-Clor EC:

full rate: 200 lbs/ac

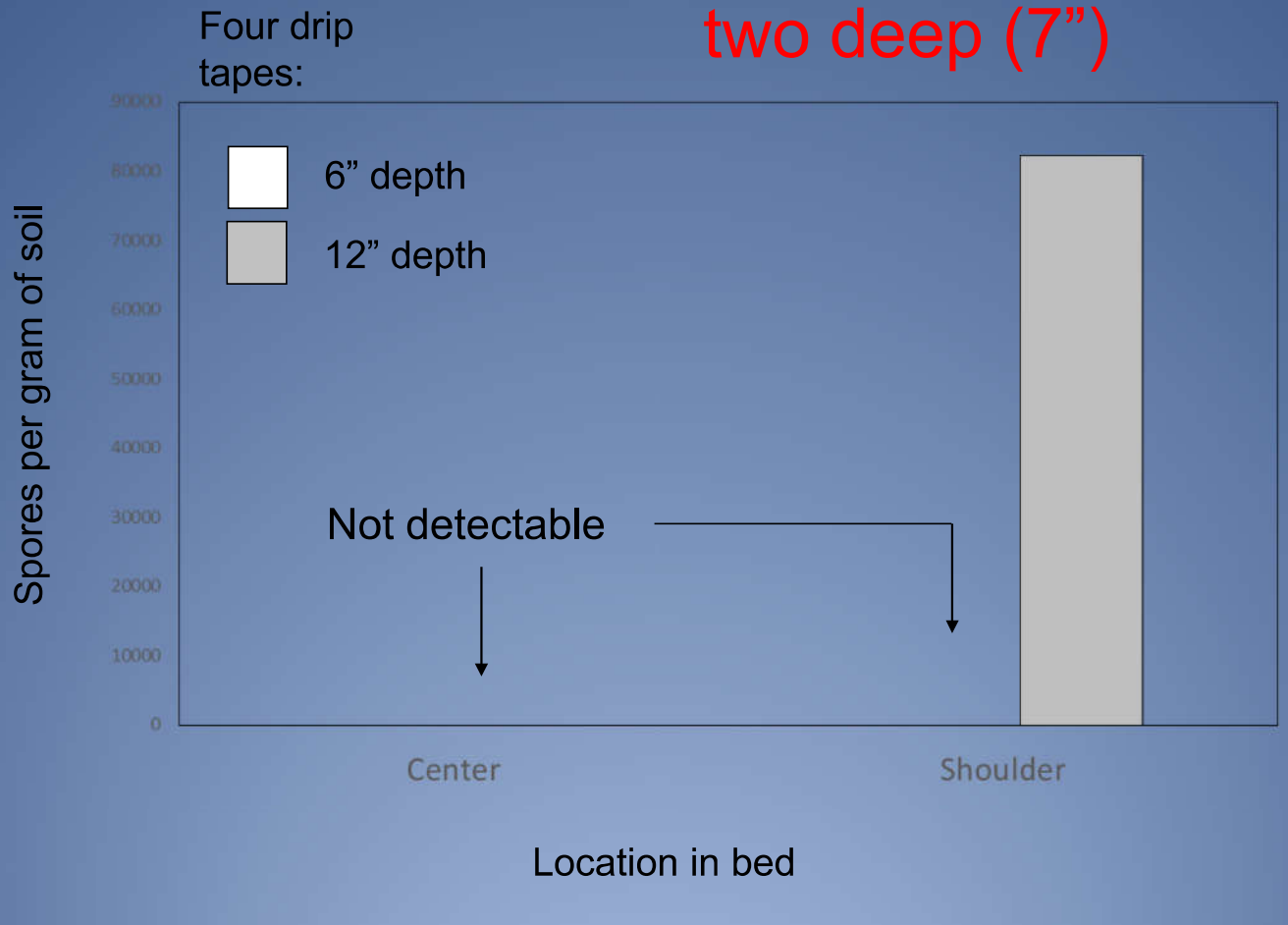
half rate: 100 lbs/ac

FUSARIUM survivorship Four drip tapes at 2.5” depth:

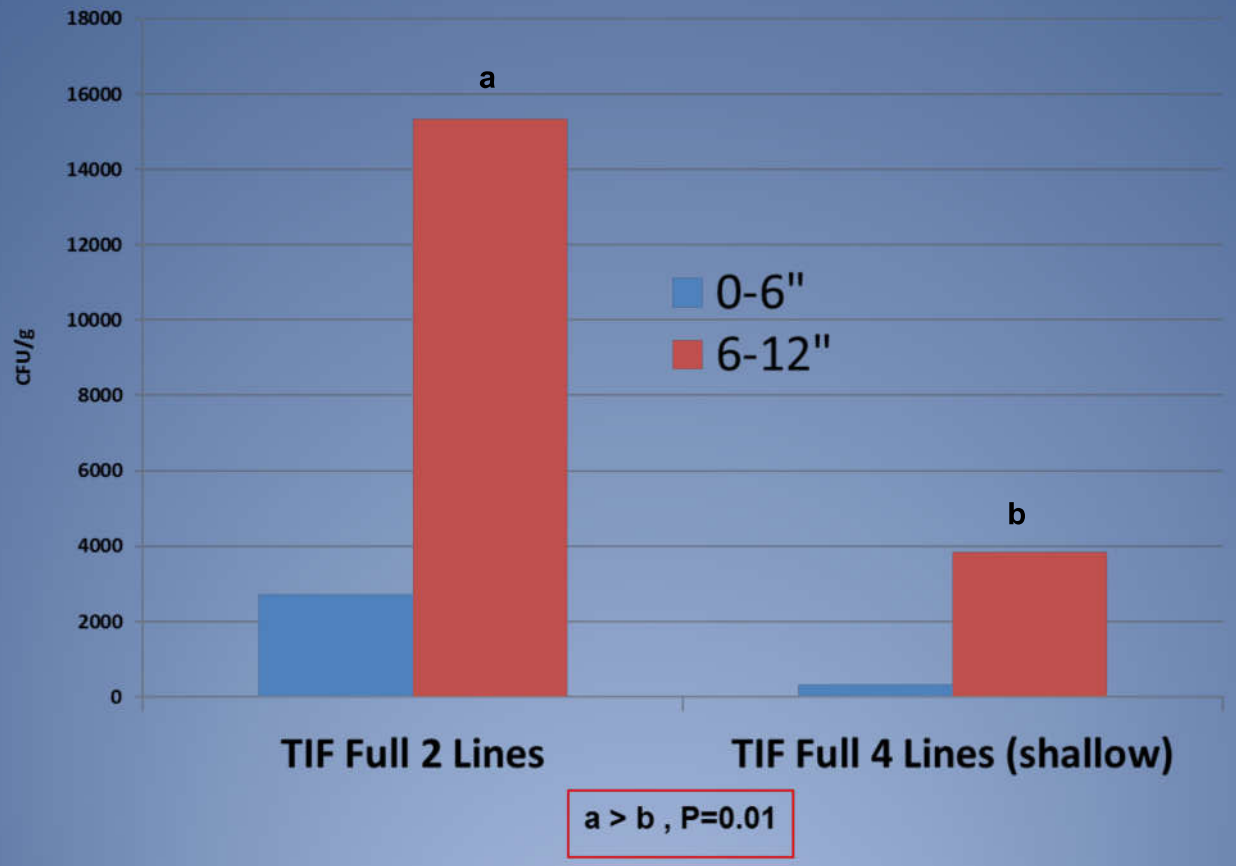


FUSARIUM survivorship

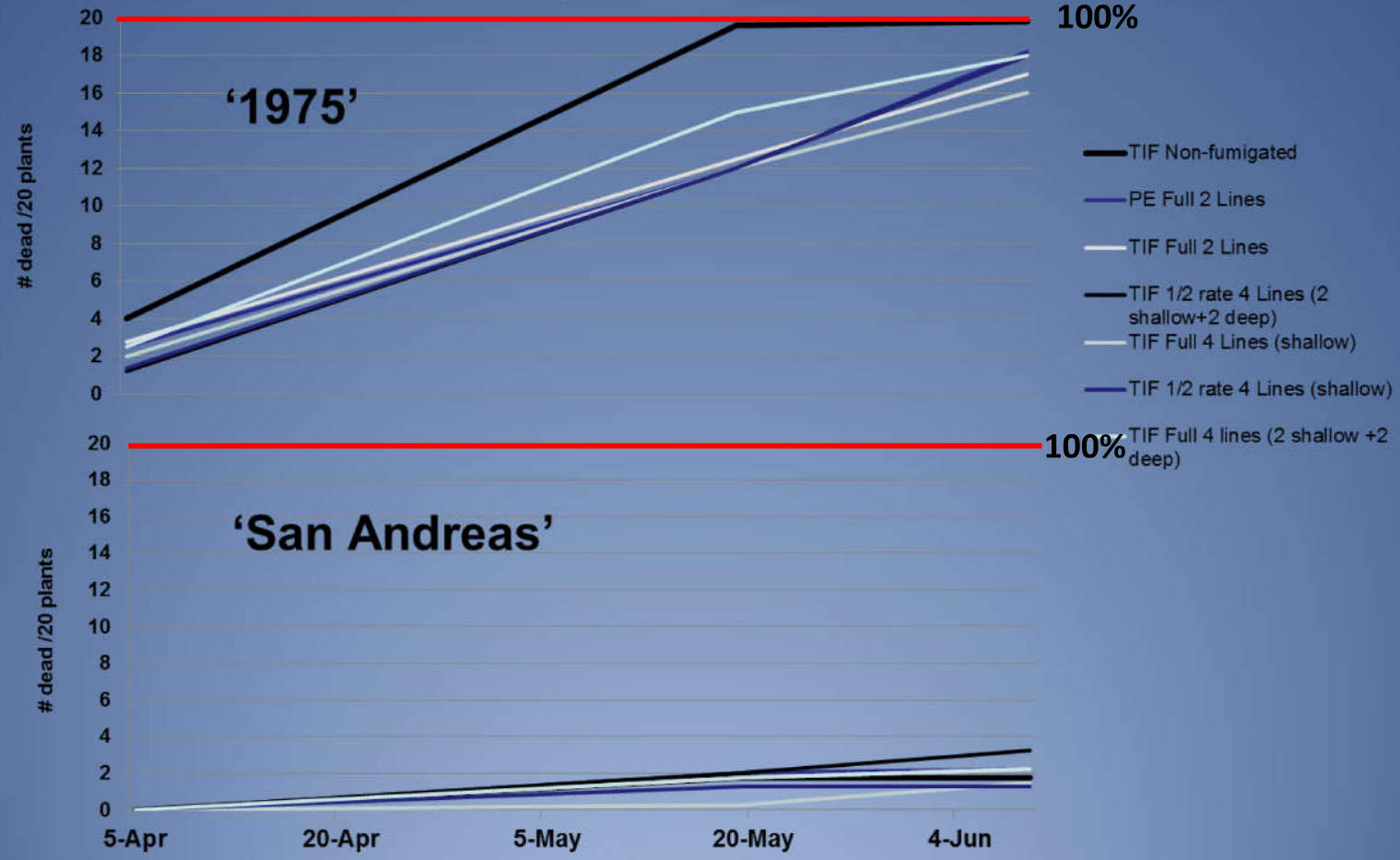
two shallow (2.5”) + two deep (7”)



Fusarium in sand inoculum



Plant mortality (due to Fusarium)



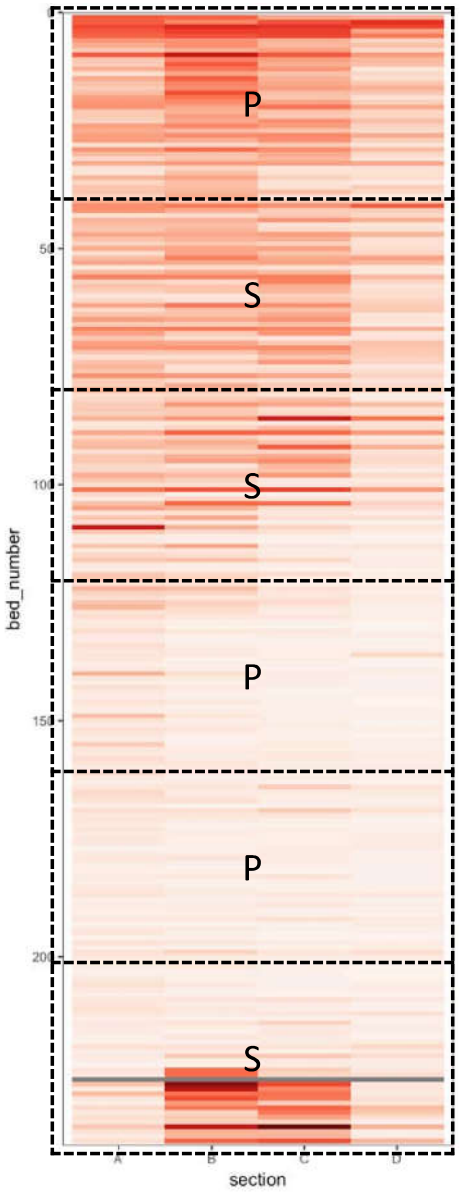
‘Fronteras’ is resistant to *F. oxysporum*?!

What else can we do?

- Removal or destruction of infested crowns
- Precision fumigation/or other management based on need
- Using low-cost MITC generators as only pre-plant fumigants
- Getting new varieties with genetic resistance/tolerance

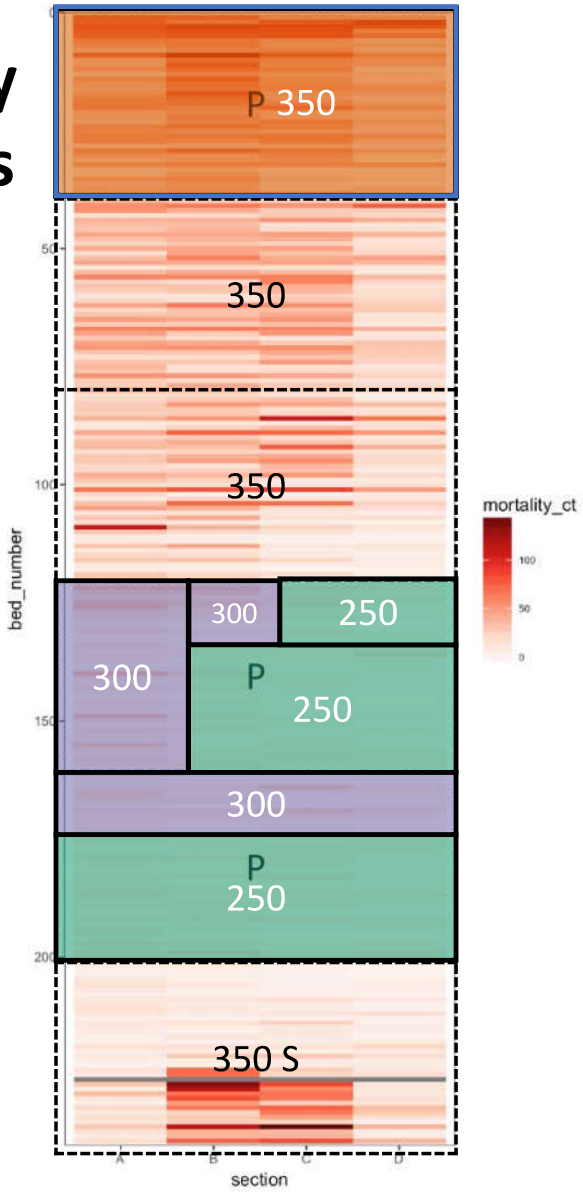
Mortality and rates

S = Standard
P = Precision

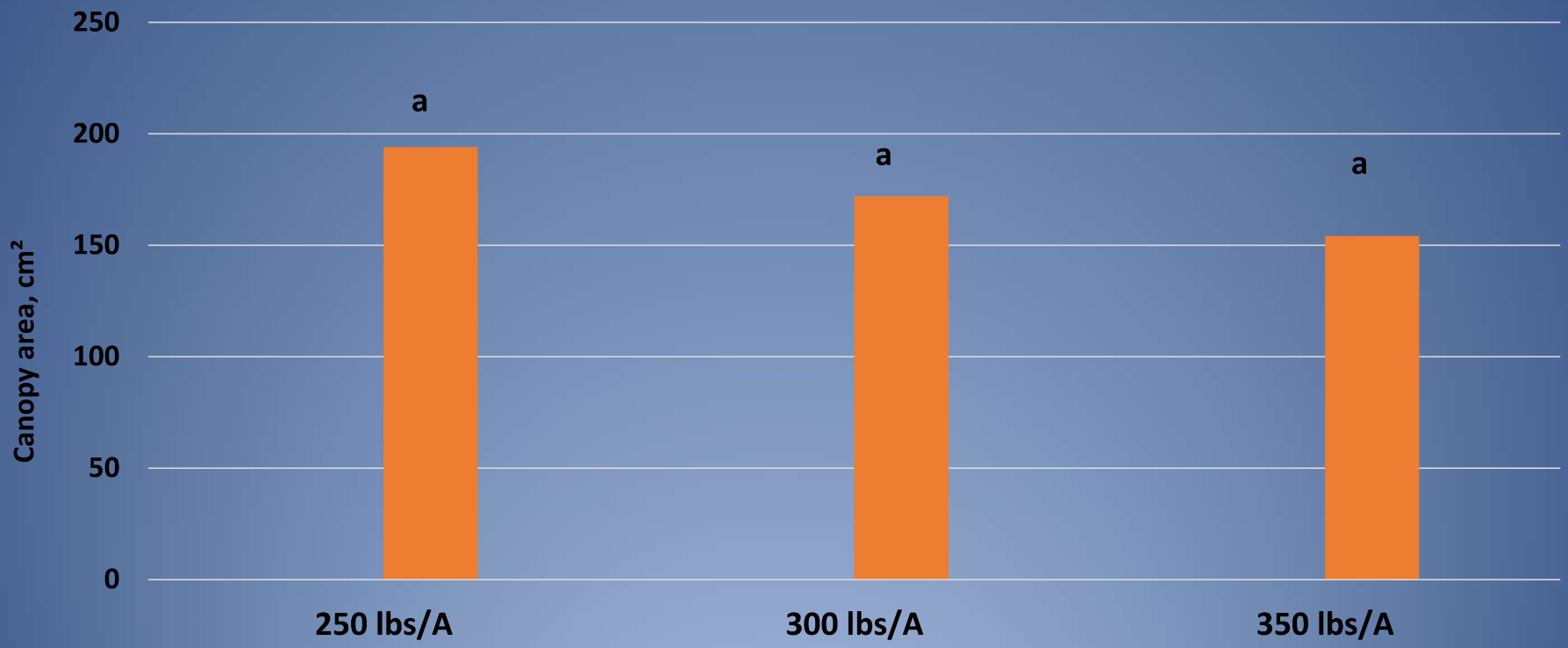


Rate Zones

- High
- Medium
- Low



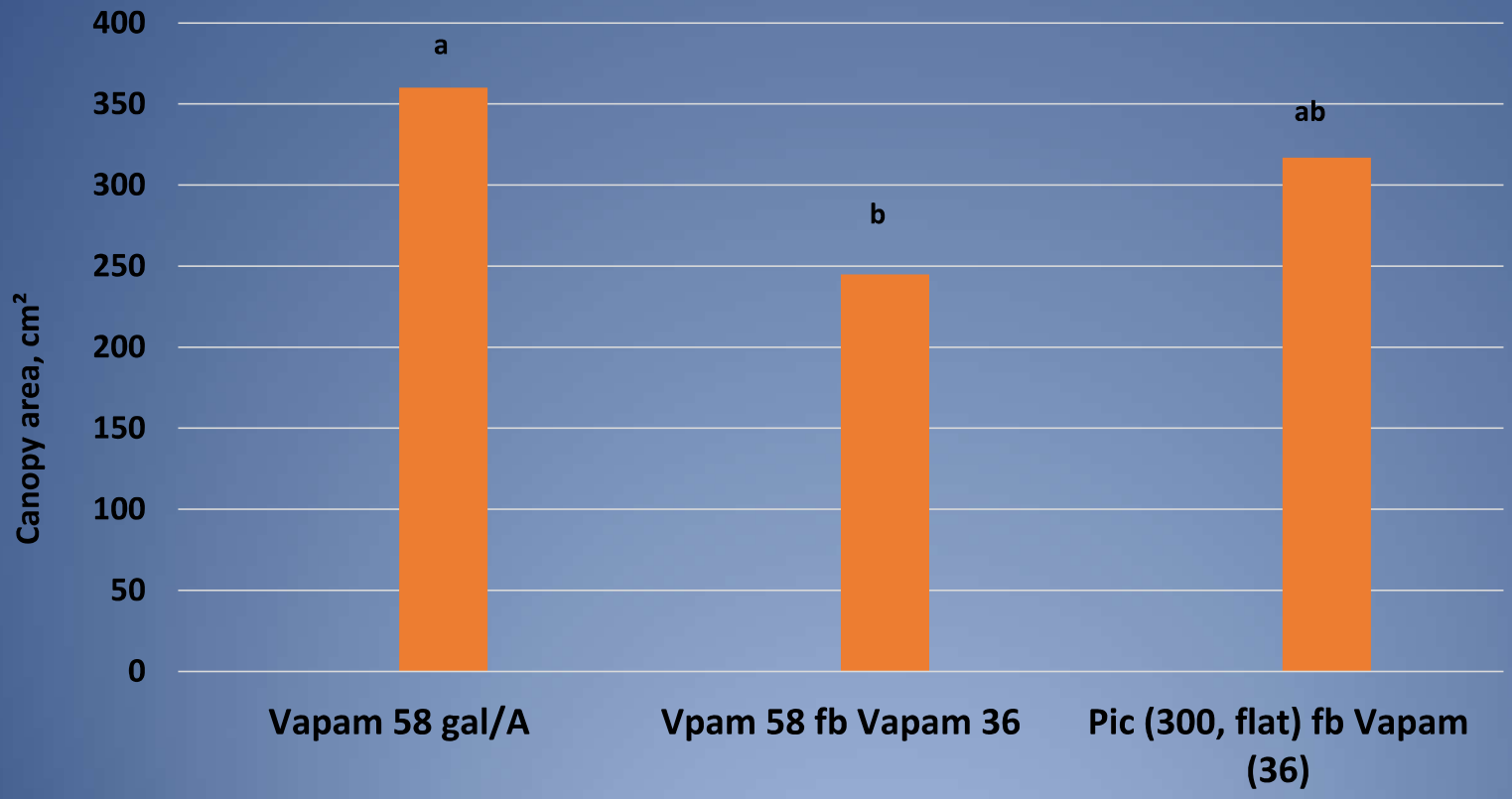
Plant early vigor after flat Pic



Can we sustain production with less expensive, bed-applied MBTC generators?

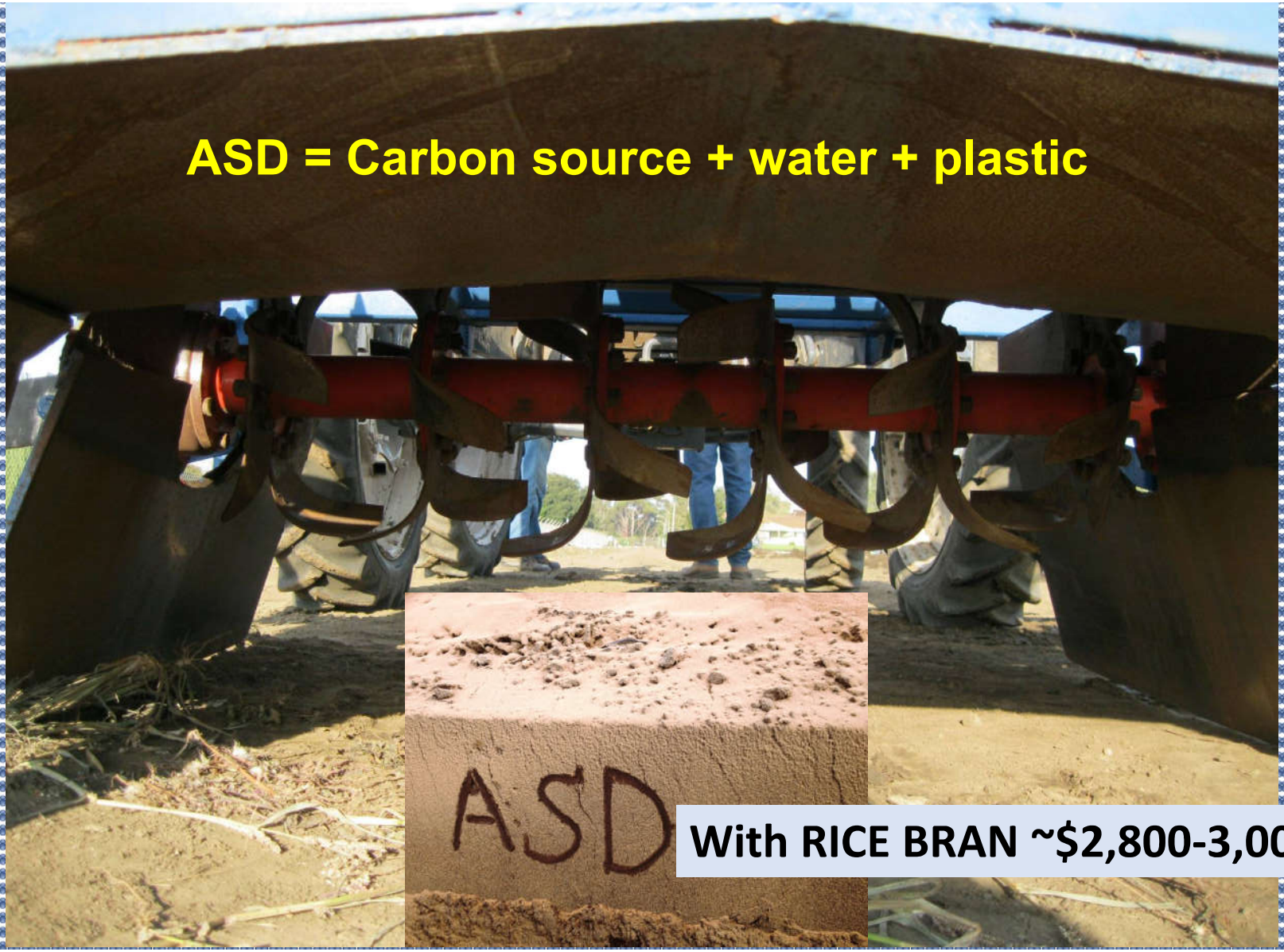
1. Vapam single application of 58 gal/A,
2. Vapam (58) fb Vapam (36) split application and
3. Vapam (36) after flat Pic (300) application

Plant early vigor

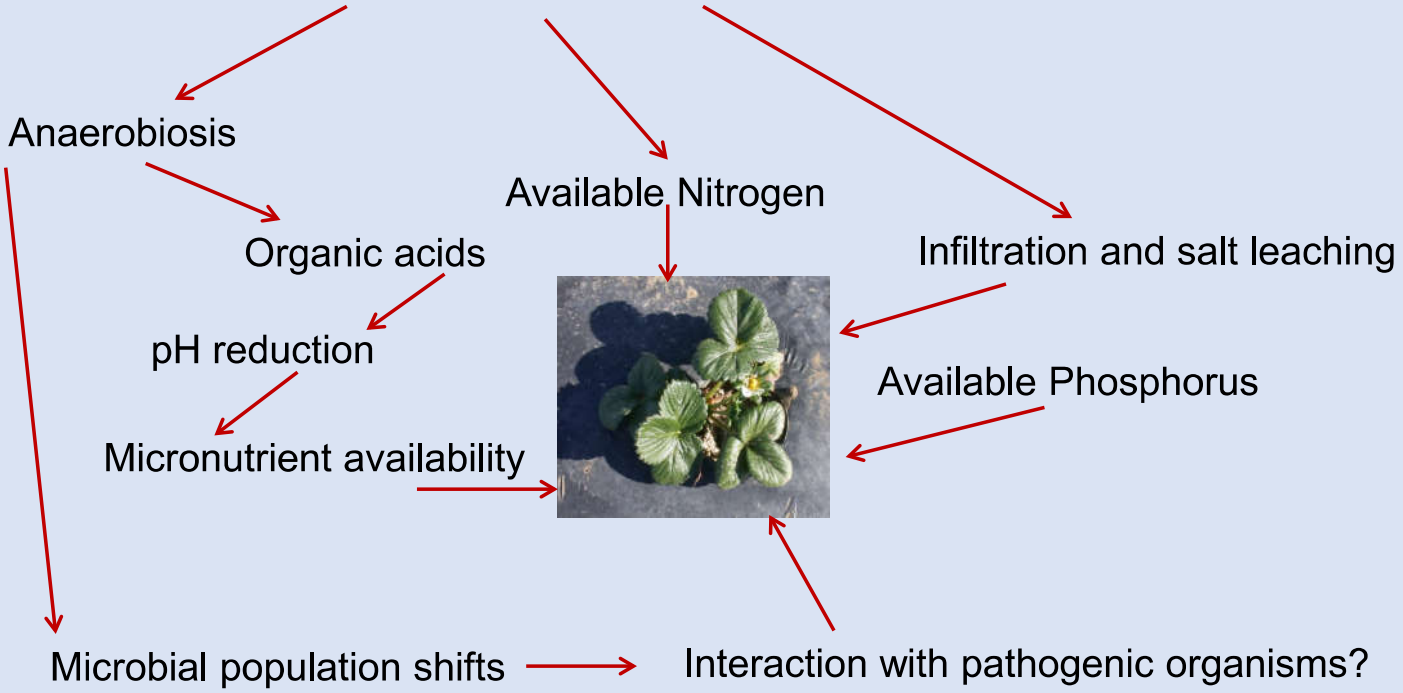


ORGANIC PRODUCTION

organic field with *M. phaseolina*: Sabrina vs Ventana


ASD = Carbon source + water + plastic
ASD
With RICE BRAN ~$2,800-3,000/A

Adding rice bran to soil for ASD



Short vs long term?

Other C-sources and soil environments?

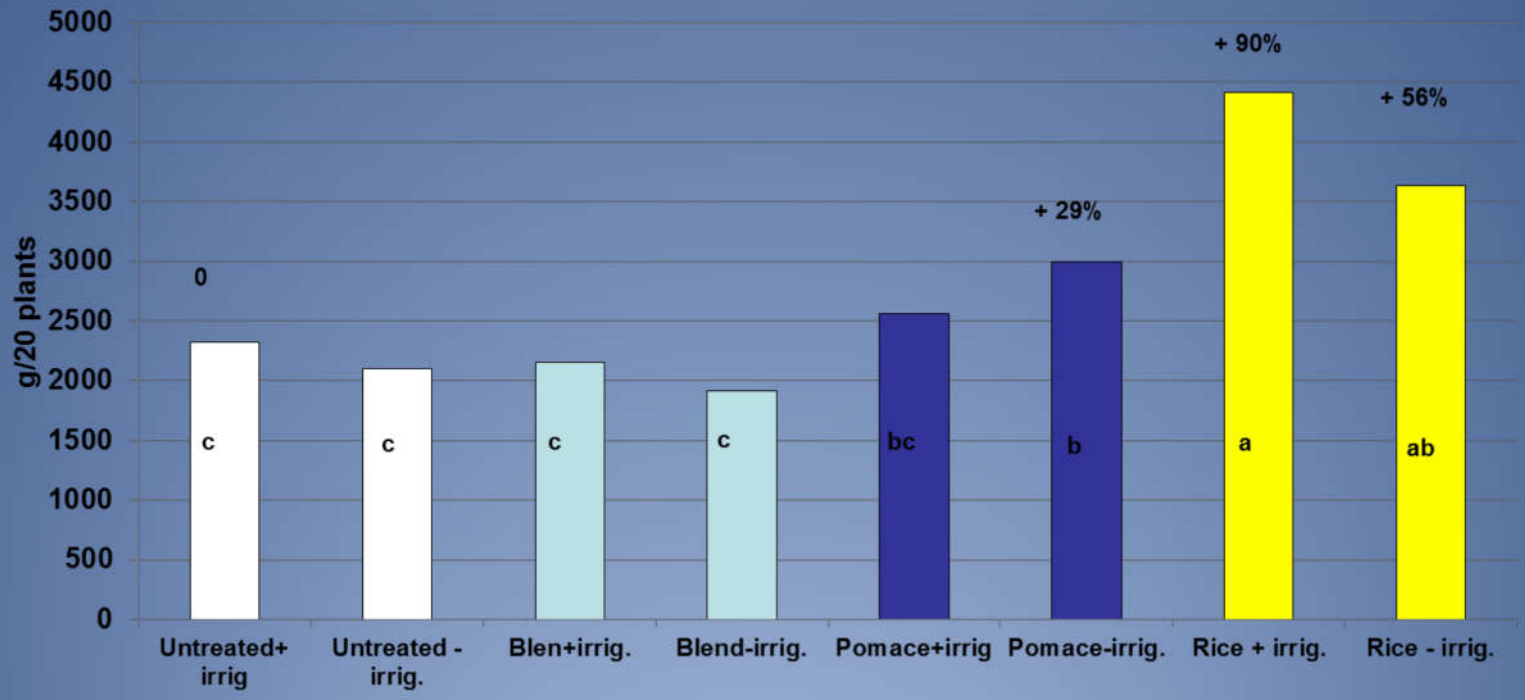
For C-source:

- Rice bran
- Glycerin
- Grape pomace
- Molasses
- Coffee grounds
- Grass clippings
- Spent grain
- And other

- Favorable C/N
- Easy to apply
- Cheap or Free and Available
- Min.Transportation
- Works consistently

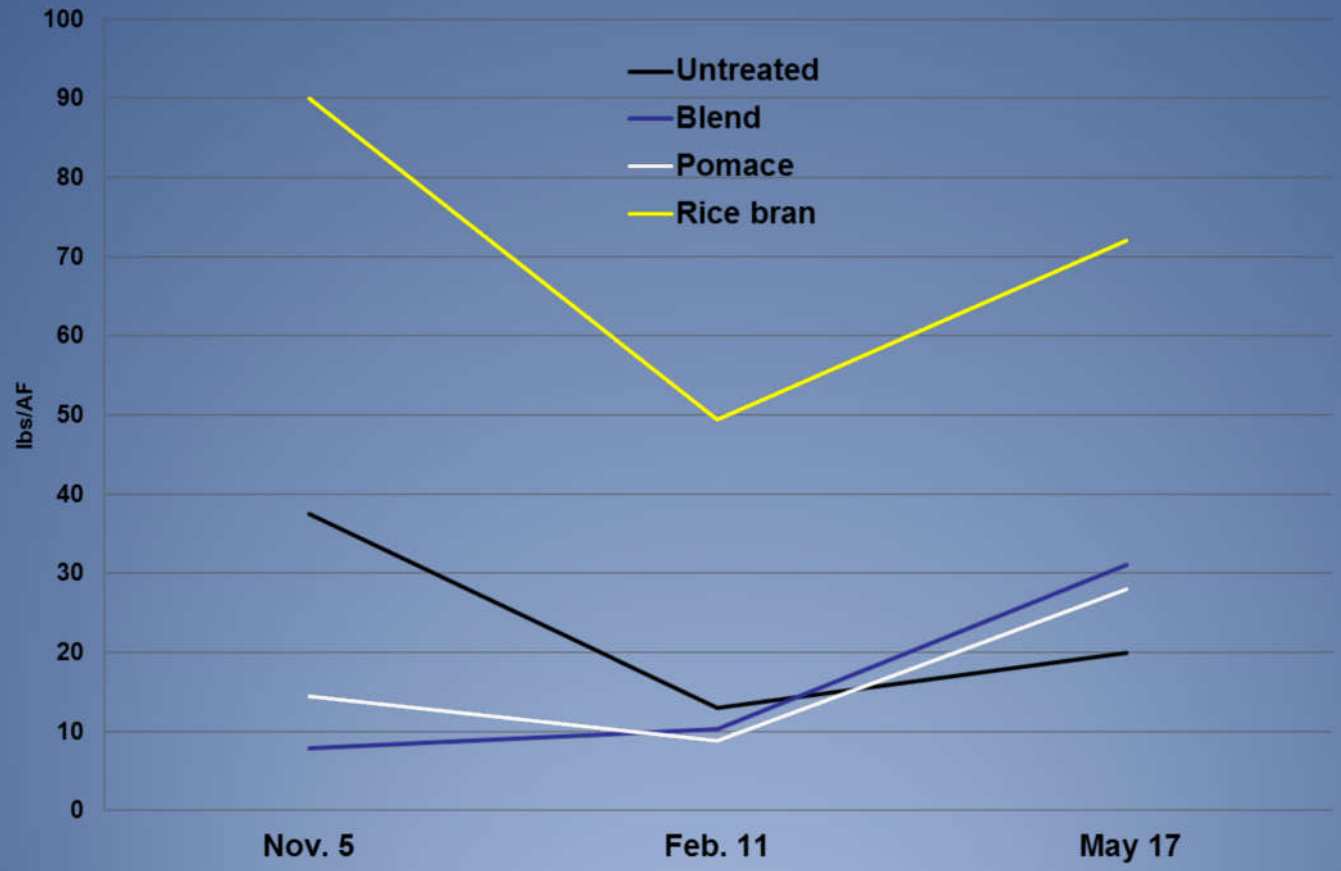
Grape pomace, rice bran and blend (rice+almond mix) in organic field

Marketable fruit yield, Dec-March



Tretements with the same letter are not signif. different at P=0.05

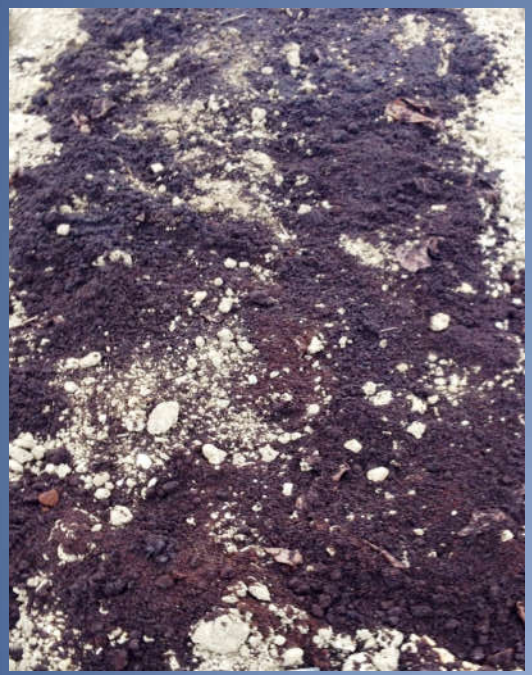
NO_3-N
at 0 -12”


100
90
80
70
60
50
40
30
20
10
0
lbs/AF
Untreated
Blend
Pomace
Rice bran
Nov. 5
Feb. 11
May 17

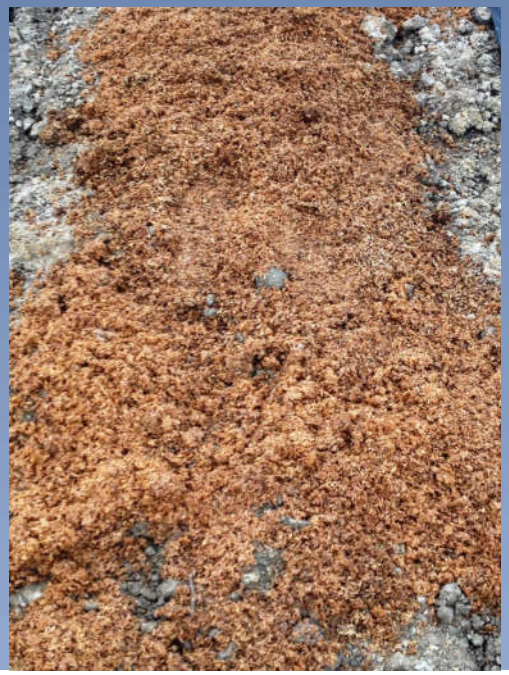
ASD C-sources:

favorable C/N ratio, local, available, cheap

Coffee grounds

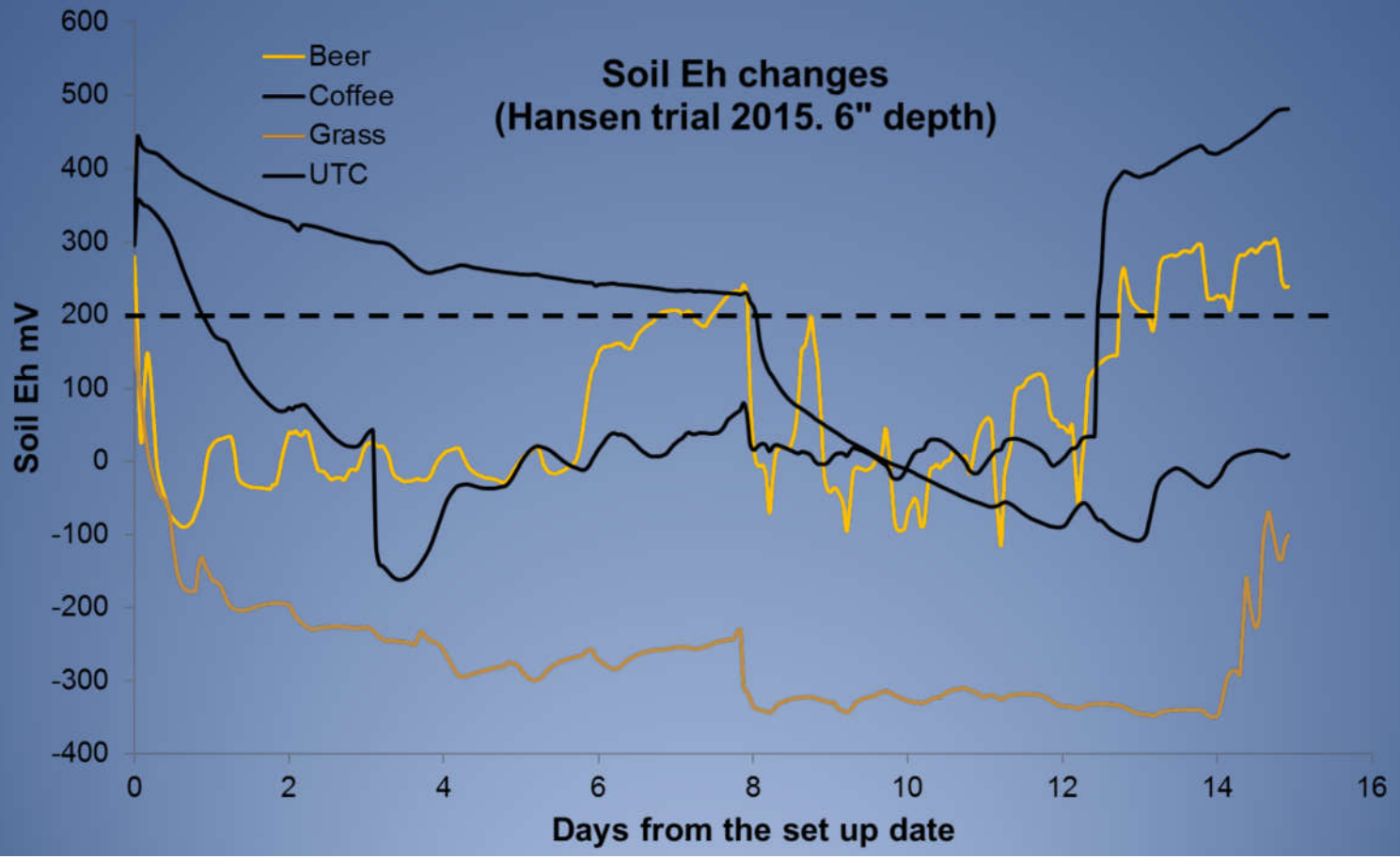


Spent grain

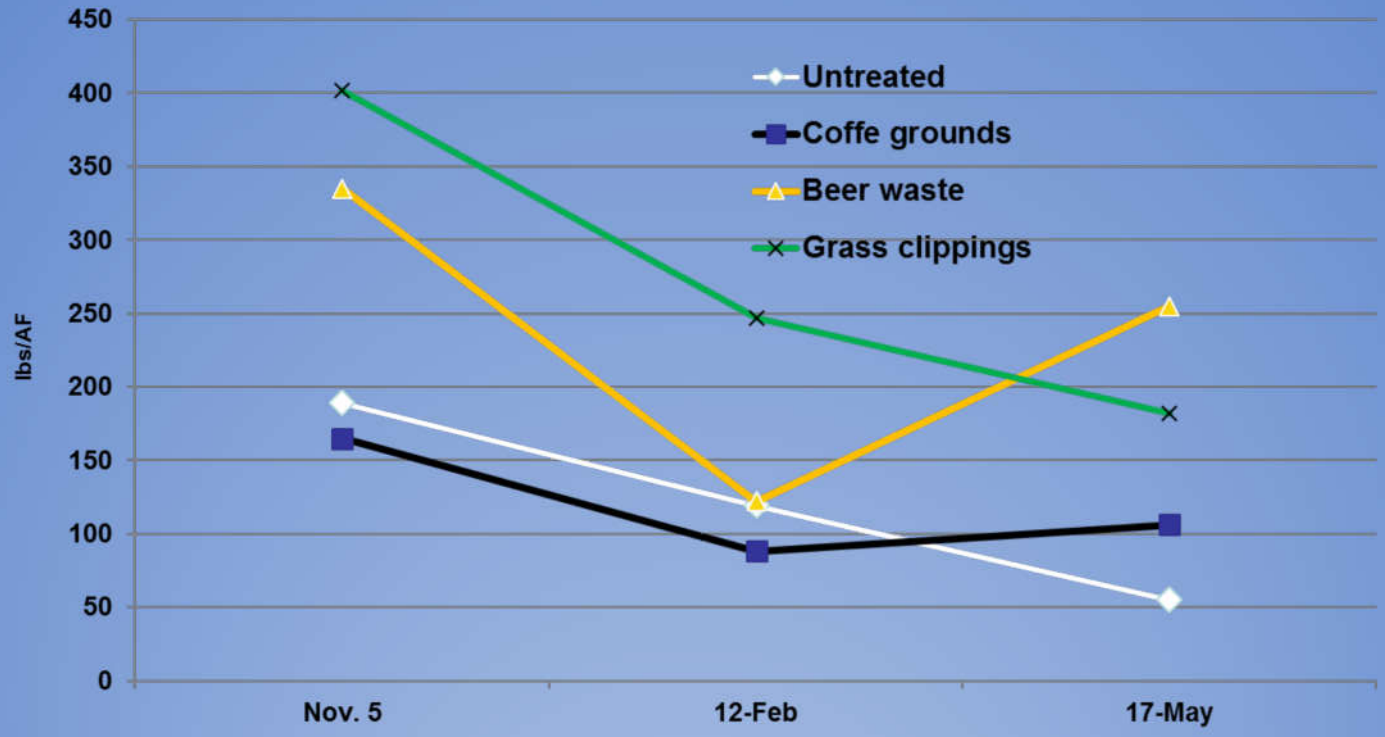


Grass clippings

Anaerobic conditions in clay loam soil (9 t dry weight /acre)

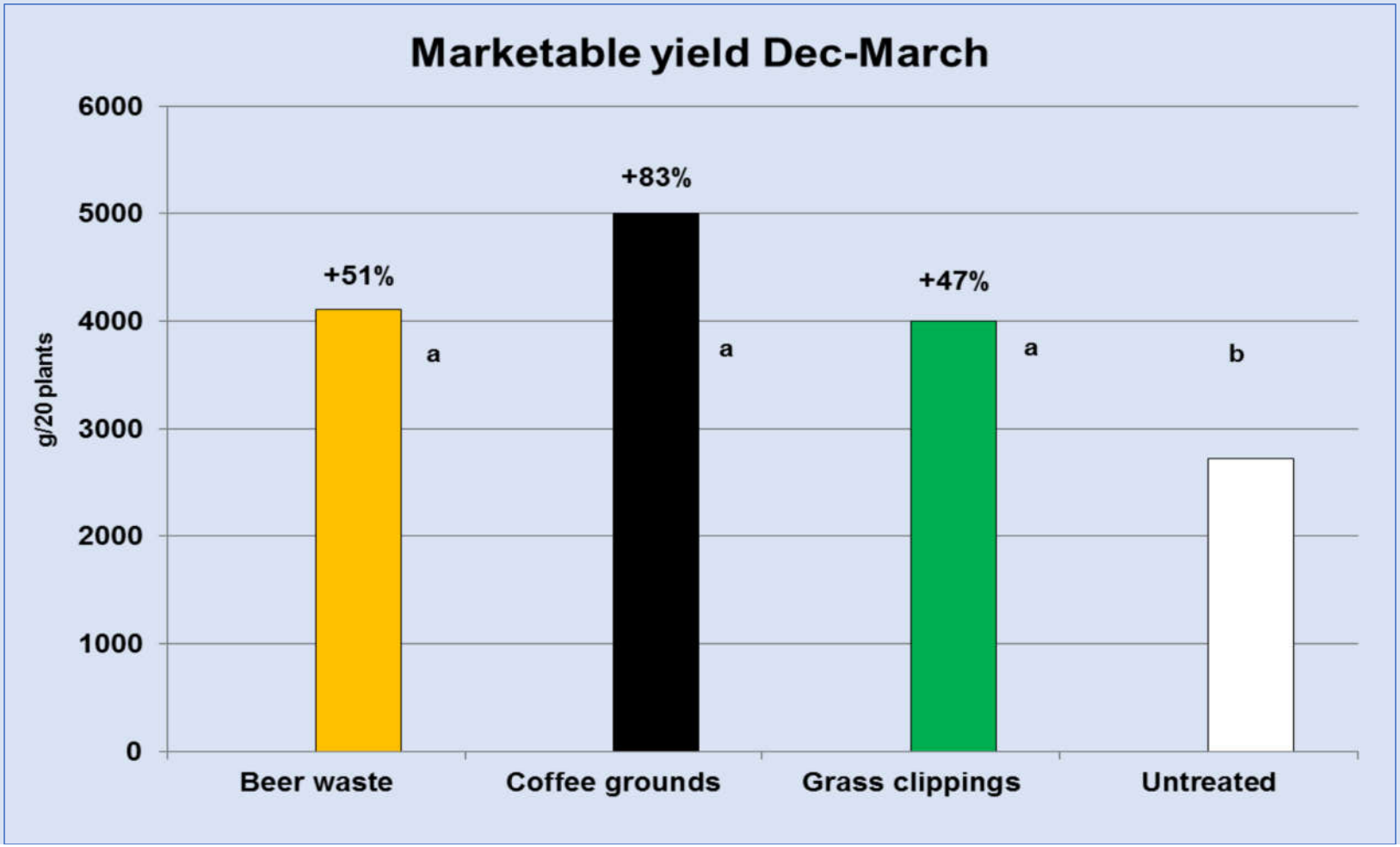


2015-16:
NO_3-N at 0 -12”



Untreated check beds received 500 lbs/A of 18-6-8 pre-plant

2015-16

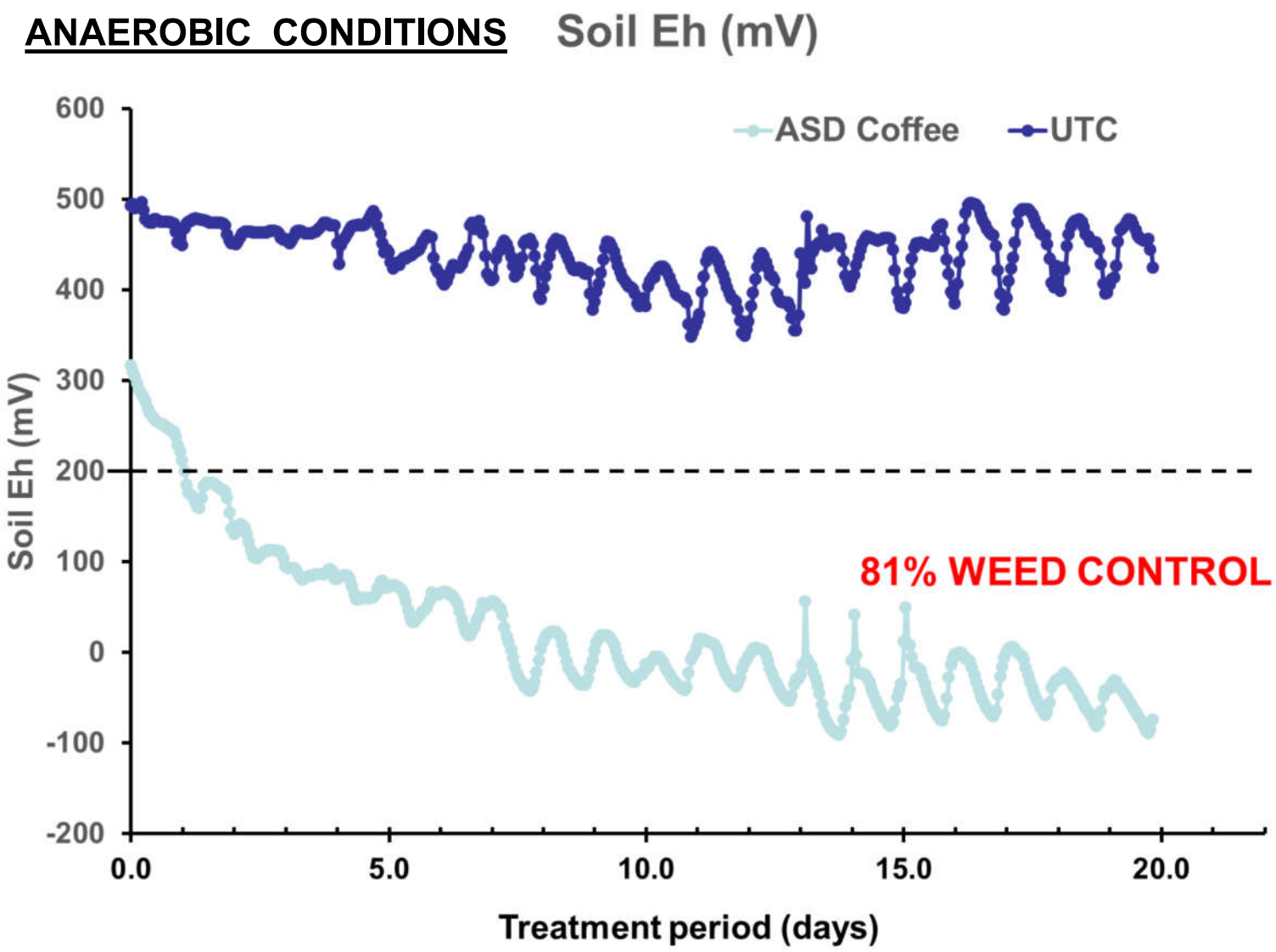

Marketable yield Dec-March
g/20 plants
6000
5000
4000
3000
2000
1000
0
+51%
+83%
+47%
a
a
a
b
Beer waste
Coffee grounds
Grass clippings
Untreated

2016-17

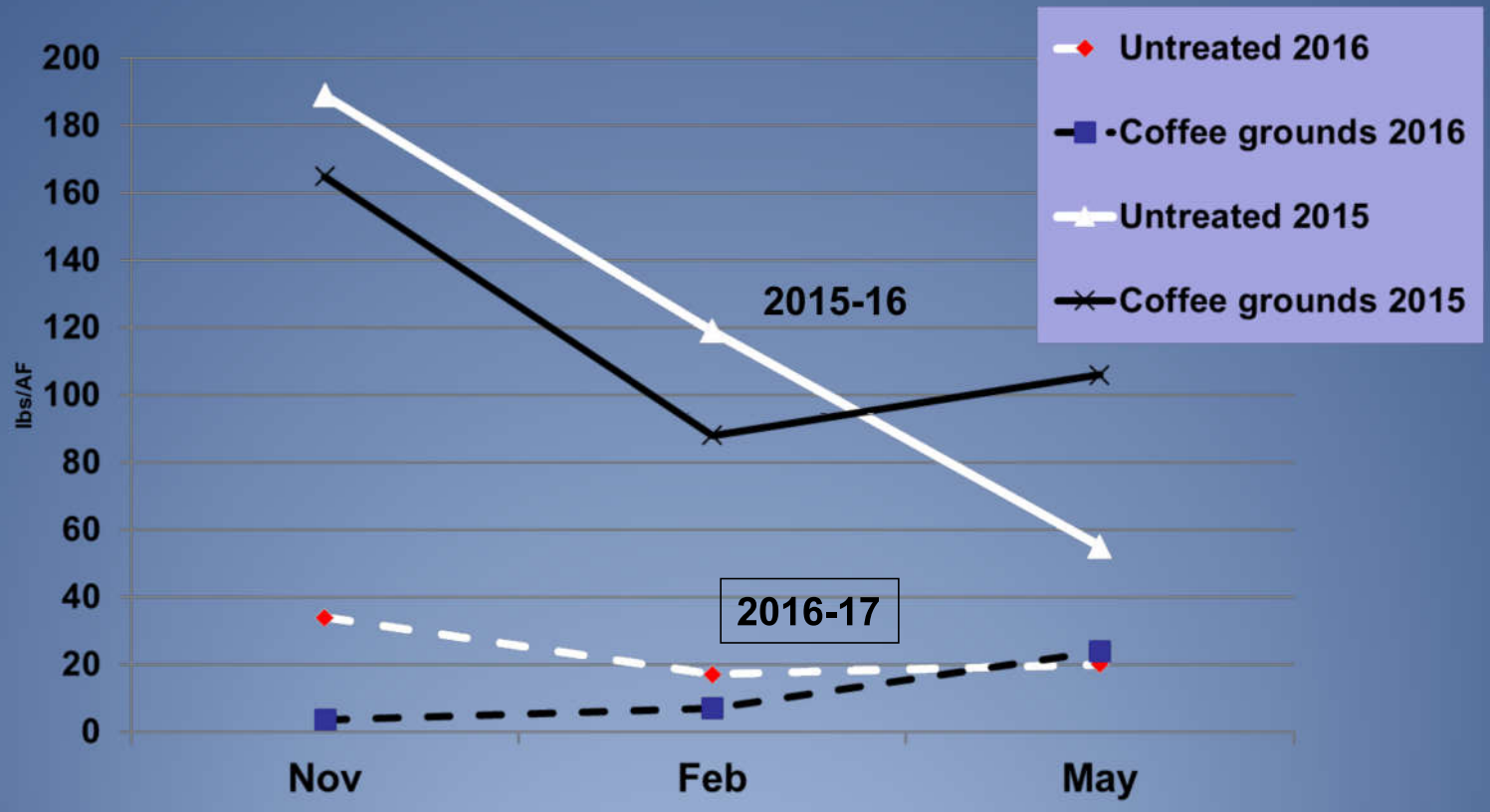
Roasting facility for Starbucks = coffee grounds

- **< 15 miles from application sites**
- **Free + free delivery**
- **15-20 cu yards available weekly**
- **Can be stored at field site**
- **Easy to apply**

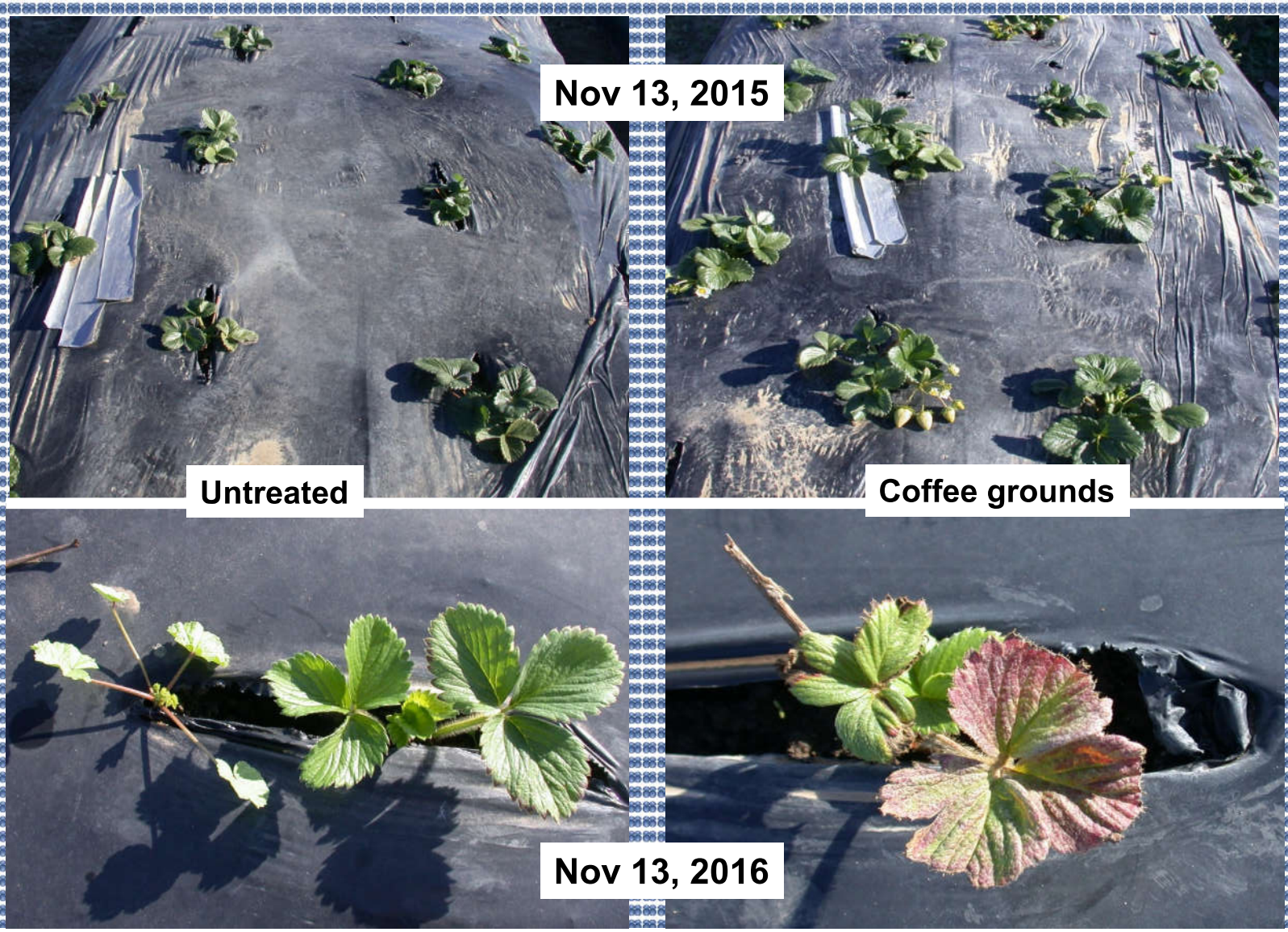
ANAEROBIC CONDITIONS



NO_3-N
at 0 -12”



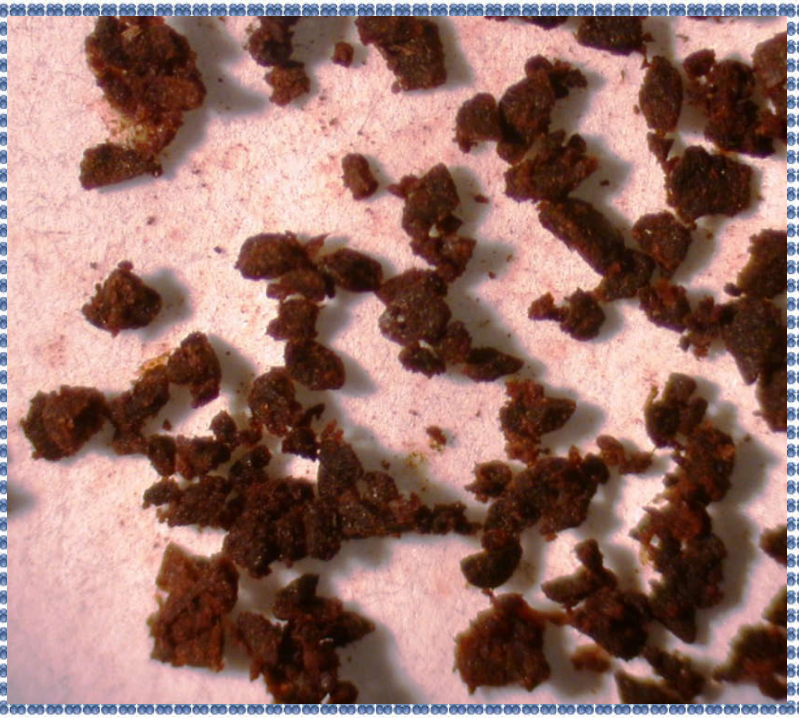
Untreated check beds in 2015 received 500 lbs/A of 18-6-8 pre-plant


Nov 13, 2015
Untreated
Coffee grounds
Nov 13, 2016

Coffee grounds (as applied)

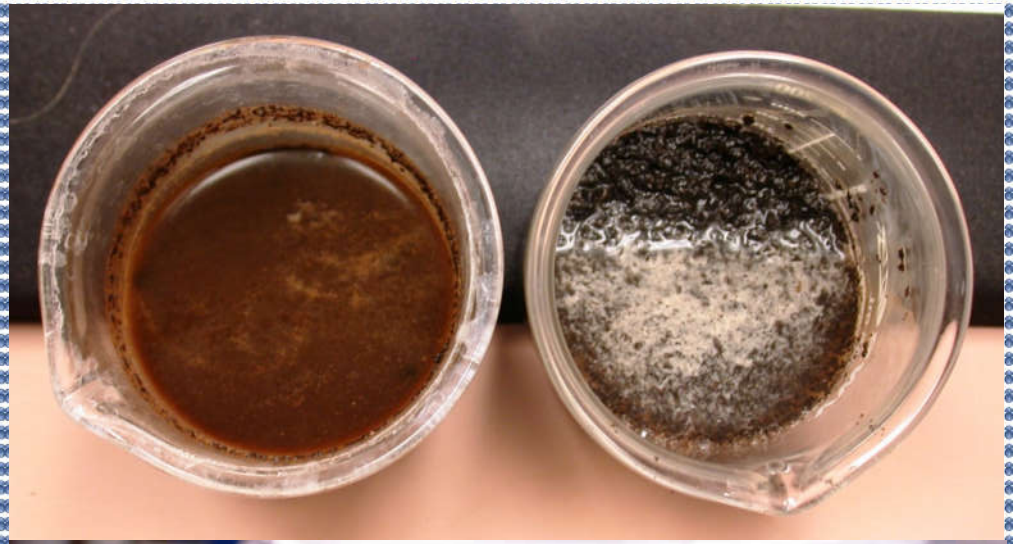
	Peet's	Starbucks
Total N, %	2.4	0.9
Total C, %	54.1	22
C:N ratio	22:1	24:1
Total P_2O_5 , %	0.1	0.1
Total K_20, %	0.26	0.23
EC, dS/m	3.5	3.1
pH	6.1	5.6
Ash %	2.5	8.4
Moisture%	63	24

Pellets

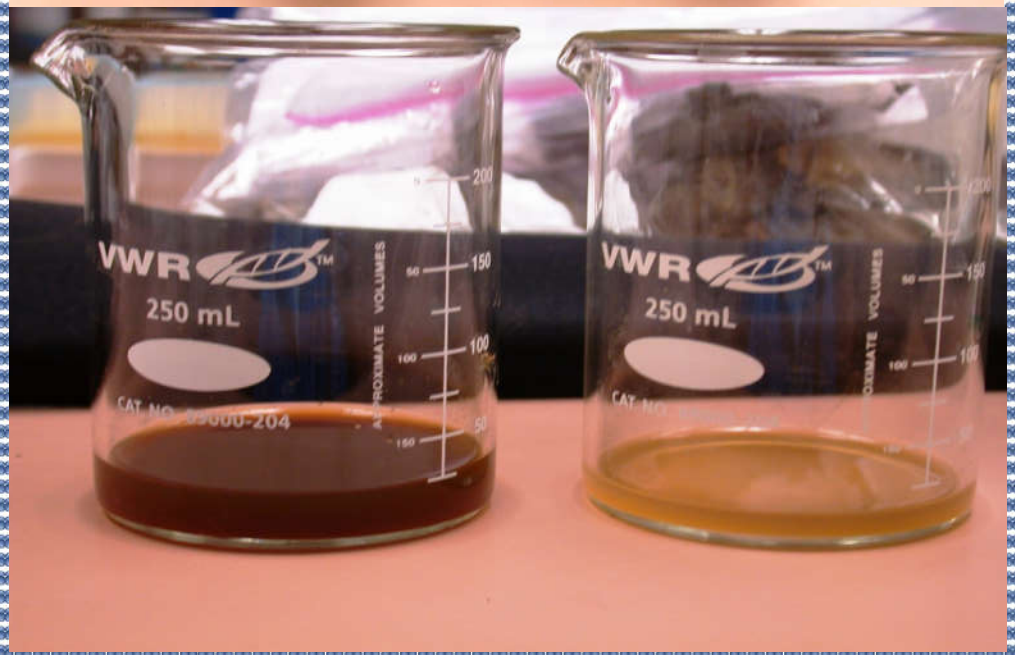


Granulates

Peets



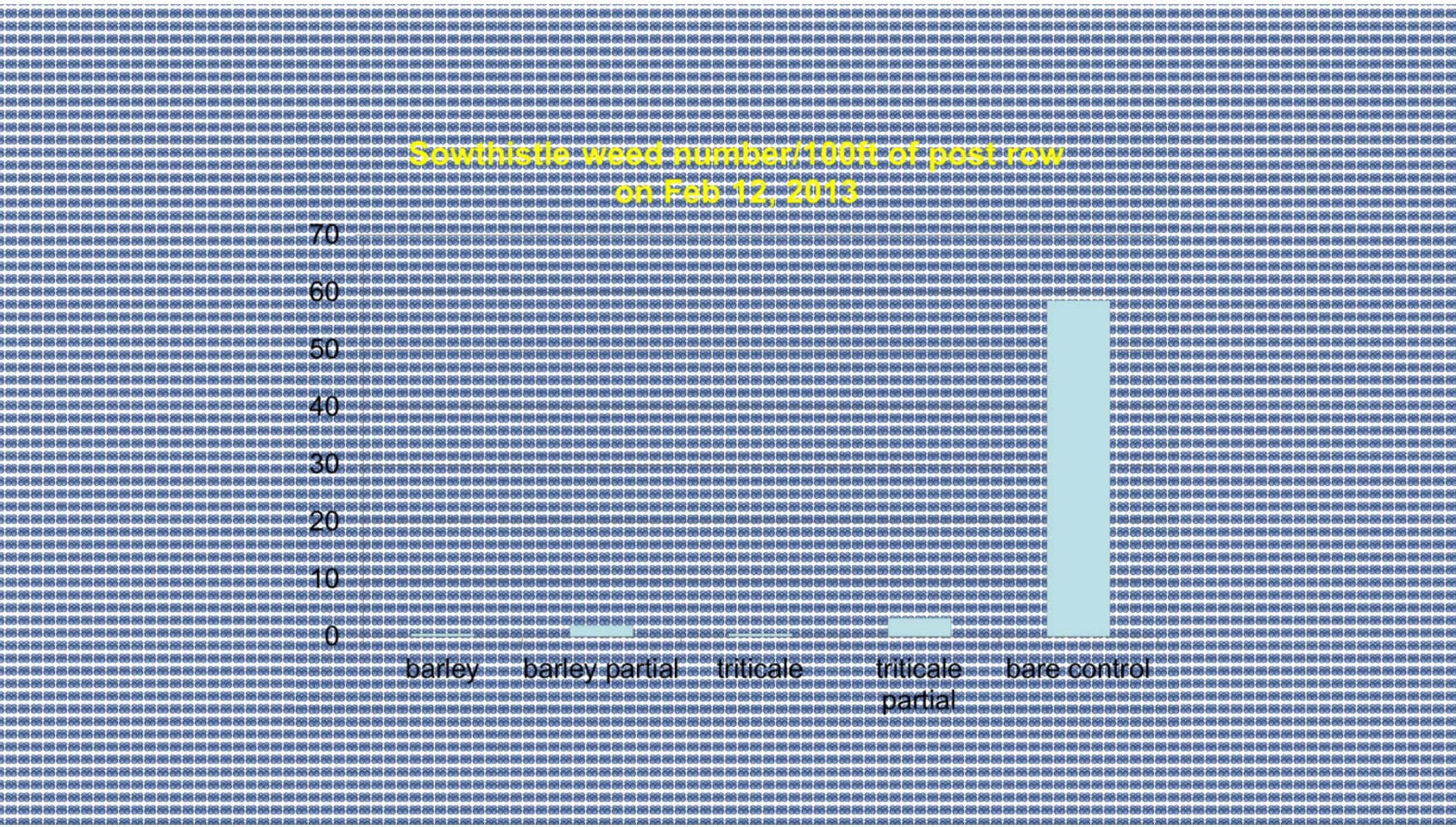
Starbucks

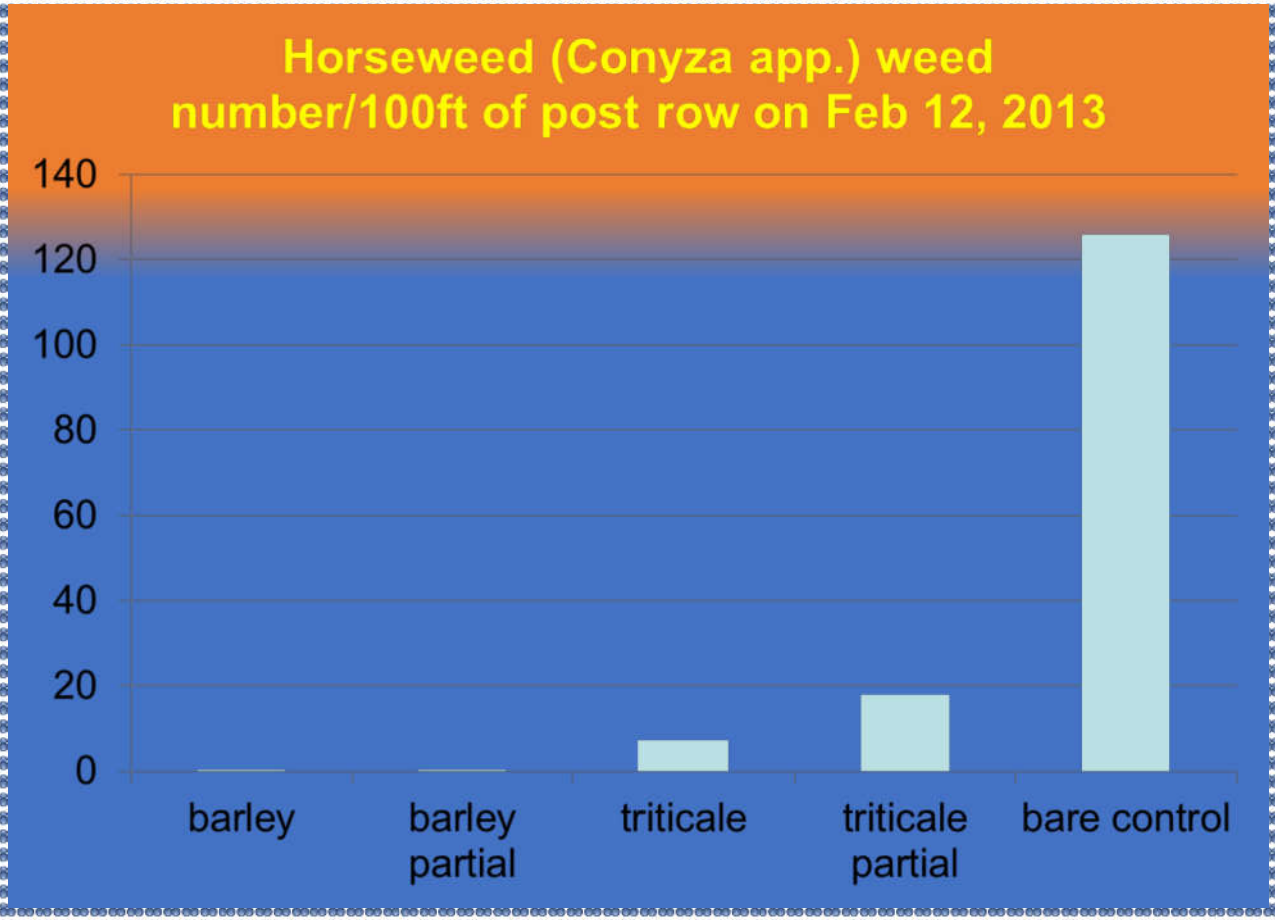


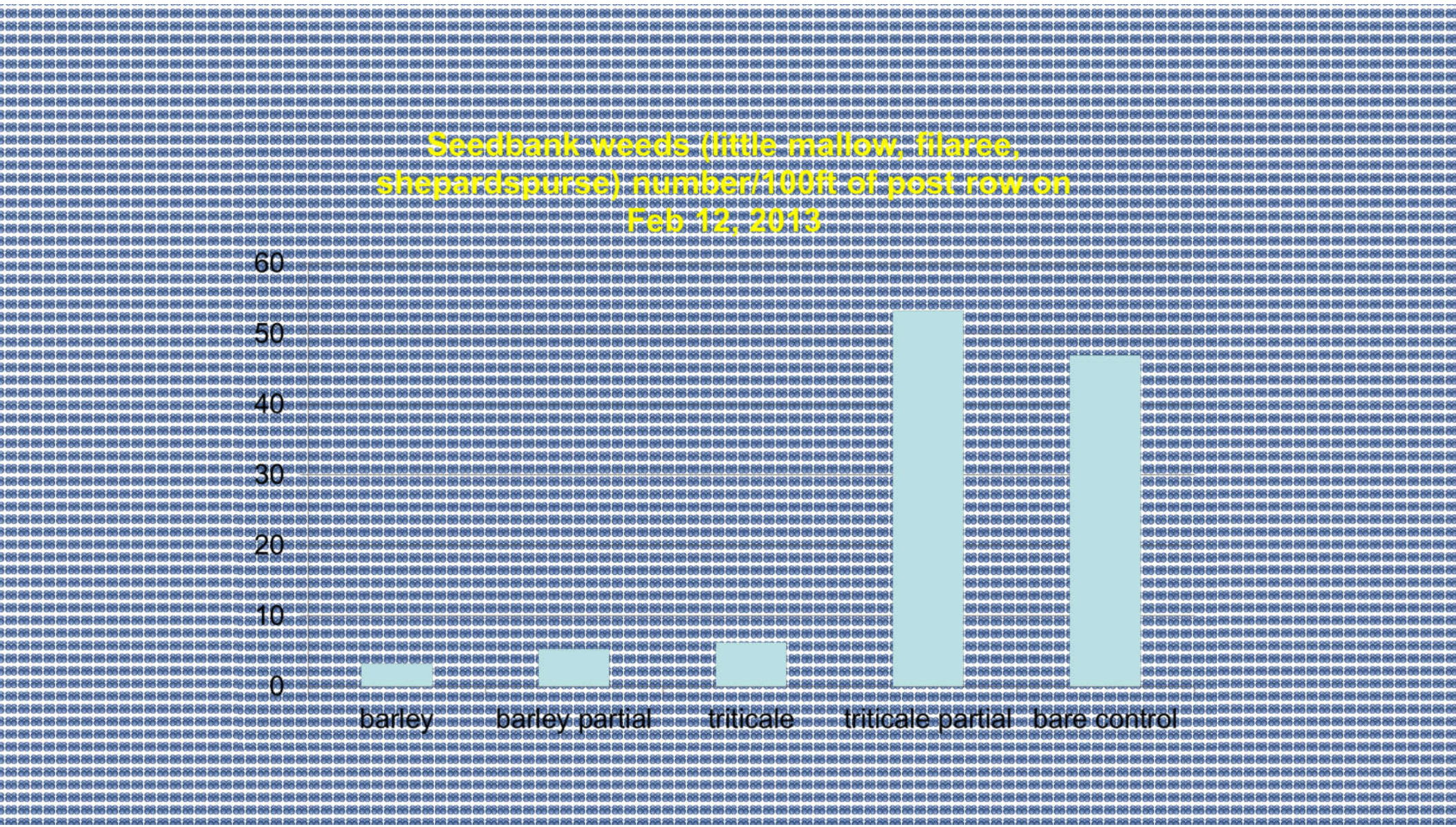
60% less

ASD-COFFEE

- In spring plants started to grow more rapidly and were not different than untreated plants (too late for fresh market)
- At another location Coffee-ASD plots had 52% fewer dead plants with *M. phaseolina* in May 2017.


Sowthistle weed number/100ft of post row
on Feb 12, 2013
70
60
50
40
30
20
10
0
barley
barley partial
triticale
triticale partial
bare control


Horseweed (Conyza app.) weed number/100ft of post row on Feb 12, 2013
140
120
100
80
60
40
20
0
barley
barley partial
triticale
triticale partial
bare control


Seedbank weeds (little mallow, filaree, shepardspurse) number/100ft of post row on Feb 12, 2013
60
50
40
30
20
10
0
barley
barley partial
triticale
triticale partial
bare control

Unweeded strip row

2016-2017

Untreated (standard)

Barley cover crop
planted at 500lbs/A,
terminated at heading
with sethoxydim and
mowing, as needed

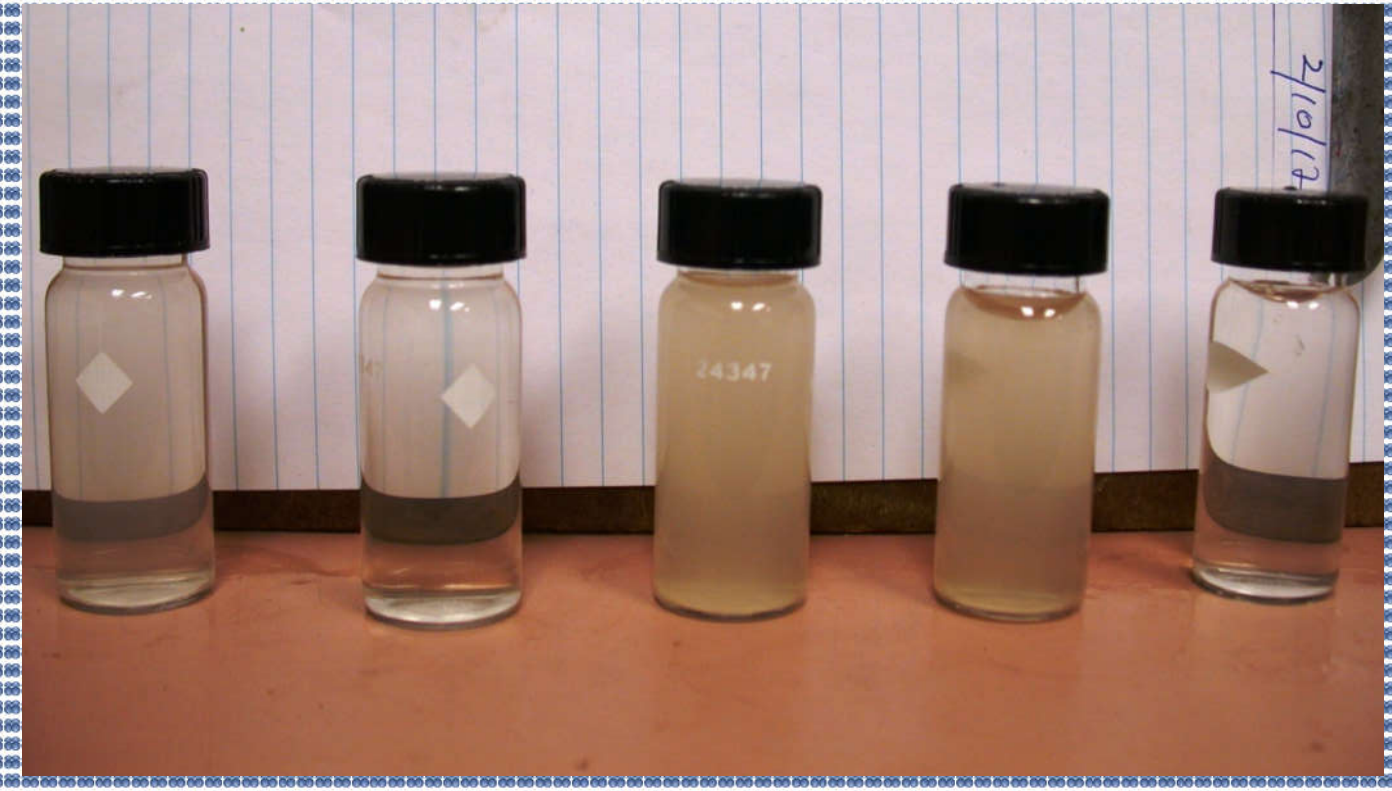
Yardwaste mulch
(1-4 inch particles)
applied 2-3 inches thick

Weed barrier
fabric placed on soil surface and pinned

Polyacrylamide (PAM, 'Simplot Soilbuilder')
applied at ~2lbs/A before rain events

TREATMENTS	Turbidity in Runoff	Nitrogen and phosphorus	Weed control/density
Untreated	**355 to 614 nephelometric turbidity units**	**N03 + NO2** : ranged from 0.25 to 1.75 mg/L **Total P:** ranged from 0.23 to 1.2 mg/L	**All species (annual sowthistle, little mallow and common groundsel) were 206 and 651 plants/1750ft^2 post row area**
Barley cover crop	**Reduced 40-59%**	**N03 + NO2** : Reduced (48%) only during 1 out of 6 rain events. **Total P:** reduced 34-50%	**Reduced 87% in Nov 2016, but only 48% in Feb. 2017 when barley straw mulch deteriorated.**
Weed barrier	**Reduced 55-85%**	**N03 + NO2** : No reduction **Total P: reduced** 35-61%	**Reduced 98%**
Yardwaste mulch	**Reduced 74-94%**	**N03 + NO2** : No reduction **Total P: Increased 22%**	**Reduced 80-90%**
PAM	**Reduced 88% when applied before rain. When soil disturbed after application, turbidity was similar to Untreated.**	**N03 + NO2** : No reduction **Total P:** Reduced 47-48%	**NO effect on weeds**

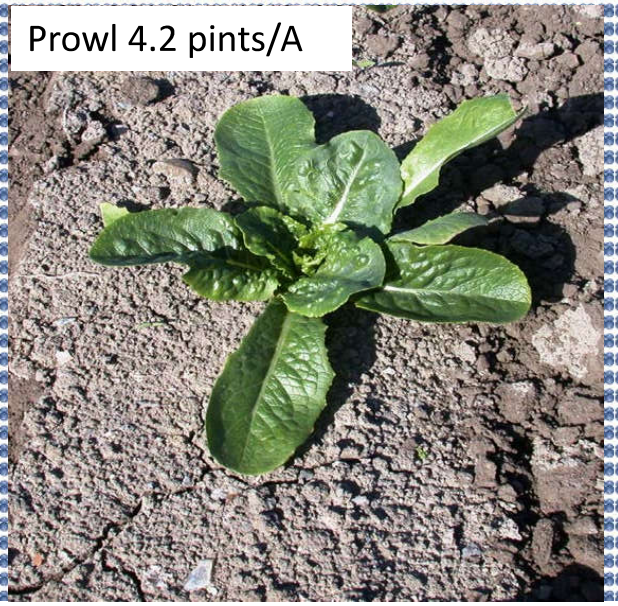
Turbidity of runoff

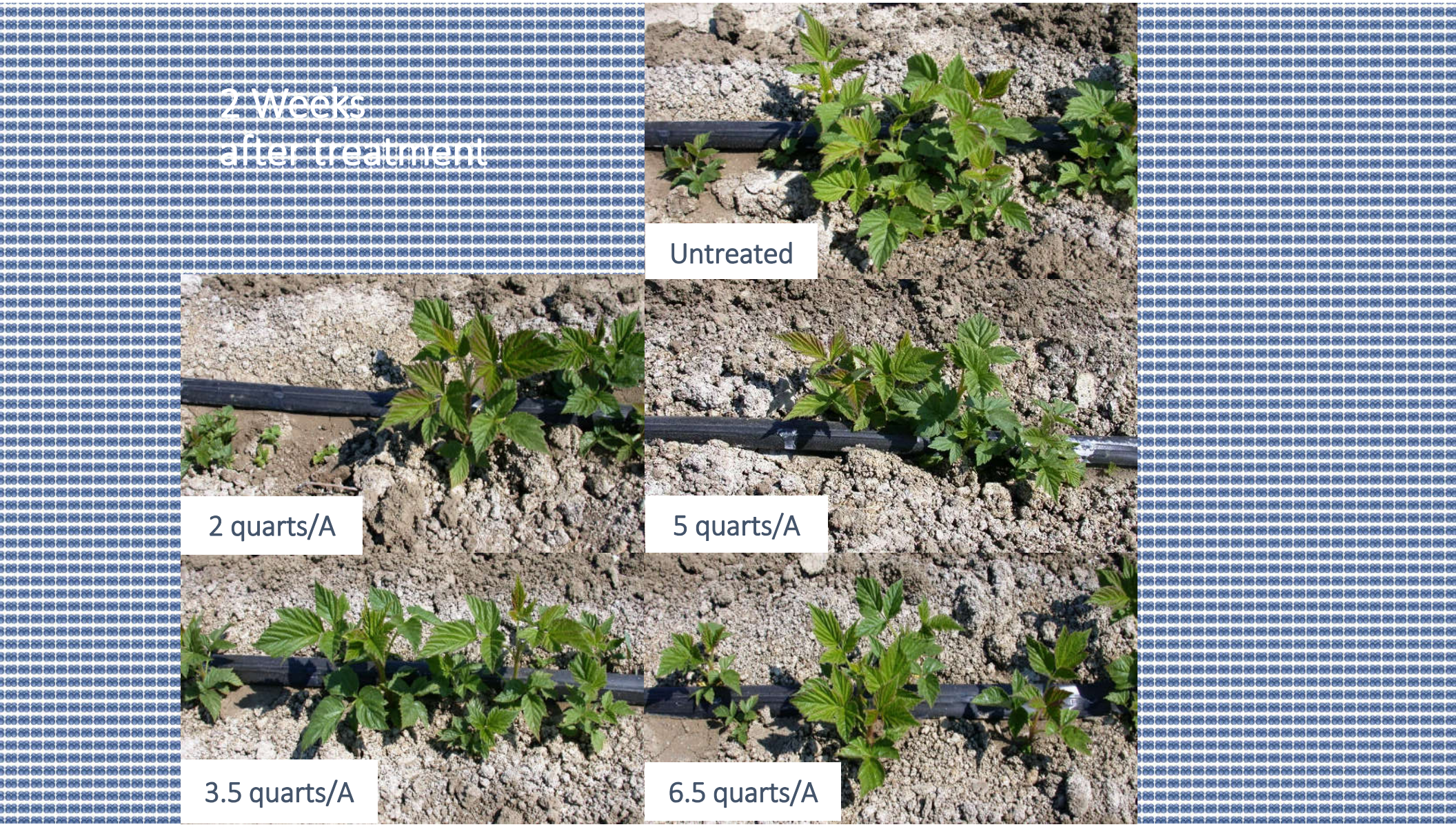


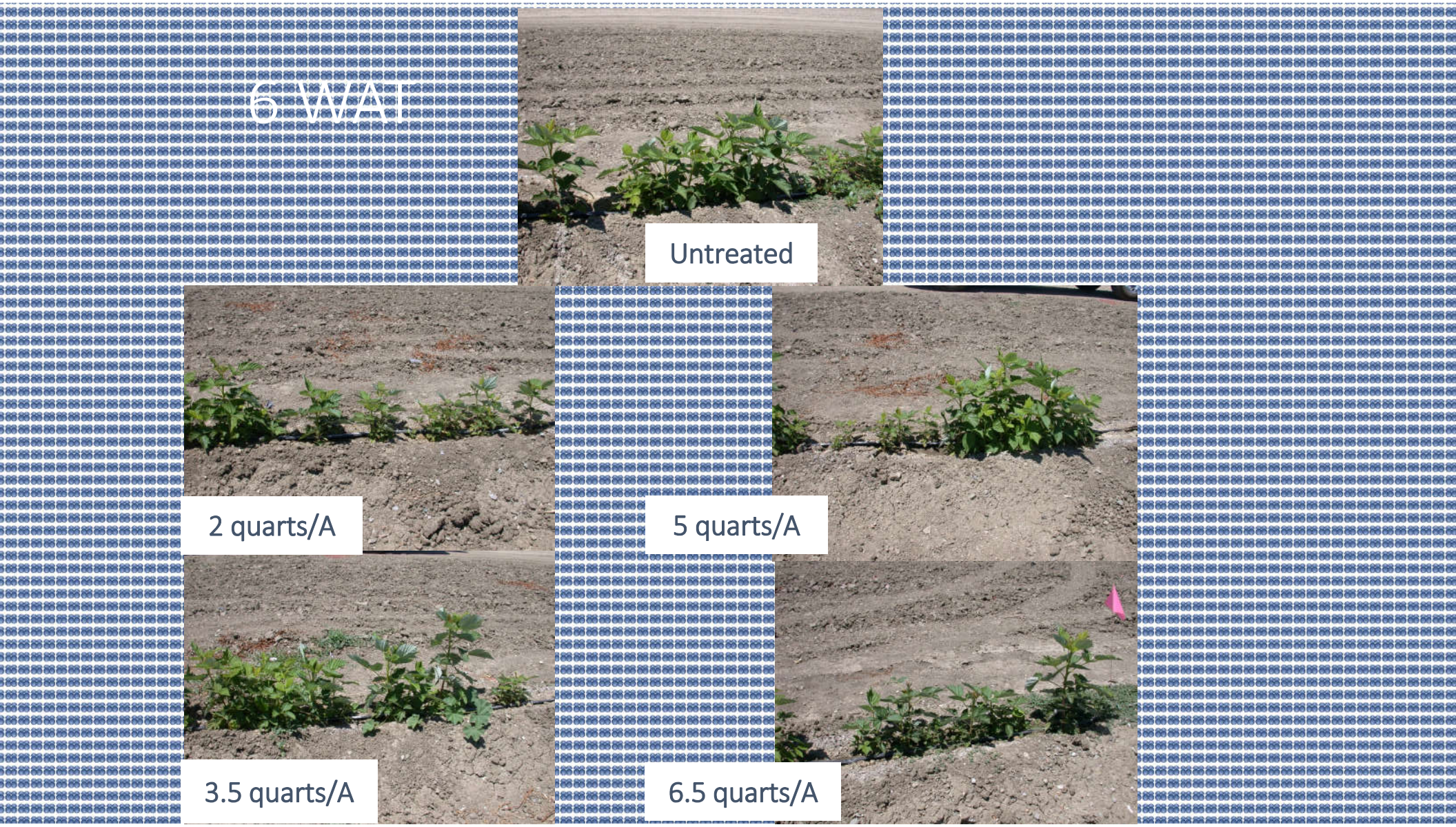
Weed barrier | Barley | Untreated | Mulch | PAM

Experimental Prowl H2O Information

- Plant roots, irrigate and apply herbicide to beds
- Can be applied to post-rows/furrows in-season
- Effective and non-injurious in transplanted lettuce

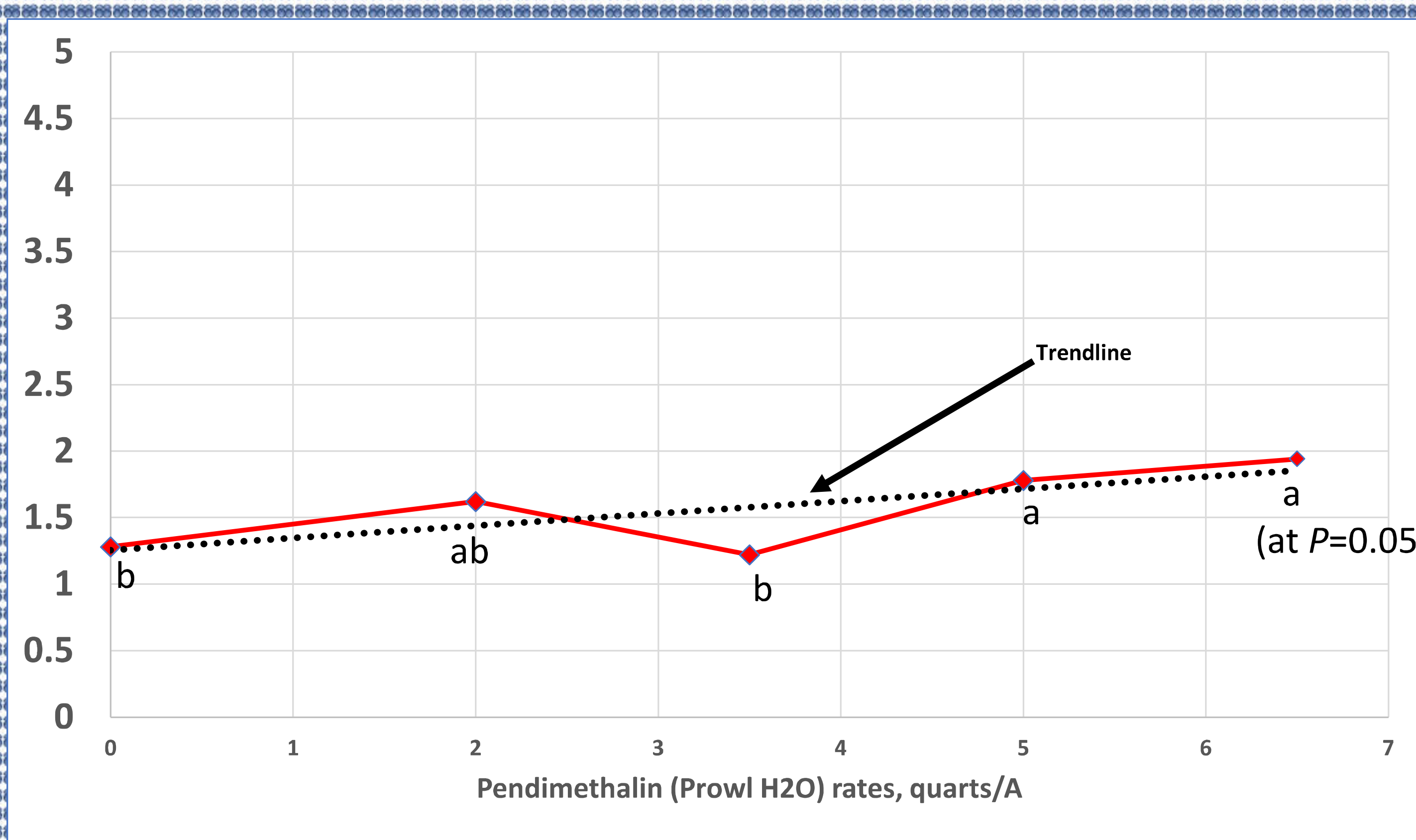



2 weeks
after treatment
Untreated
2 quarts/A
5 quarts/A
3.5 quarts/A
6.5 quarts/A


Untreated
2 quarts/A
5 quarts/A
3.5 quarts/A
6.5 quarts/A

Injury or stunting from saturation of root zone?

Prowl H2O injury in raspberry: 1 (none) to 10 (dead)



2.4-D injury

Young shoots

2 ft tall cane

Acknowledgements

- Matt Conroy and Dave Murray (Andrew and Williamson fresh produce)
- Hector Gutierrez (Otillo Farms)
- Henry Ito (Ito Bros.)

University of California
Agriculture and Natural Resources

UC- Riverside

Driscoll's
Only the Finest Berries

REITER
AFFILIATED COMPANIES

CDFA SCBG
and CDPR
Funding

Resource Conservation District
Ventura County

BASF