Management of *Macrophomina* and *Fusarium* with fumigants and non-fumigant treatments

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Macrophomina and *Fusarium* in soil

Fumigants

- Provide protection for most of the season
- Higher rates tend to be more efficacious

Varieties

- Some tolerant to Fusarium, not to Macrophomina (Benicia ~ Camarosa = susceptible)

Studies of pathogen hosts, fumigant and variety performance in infested fields

http://ceventura.ucdavis.edu/Com_Ag/

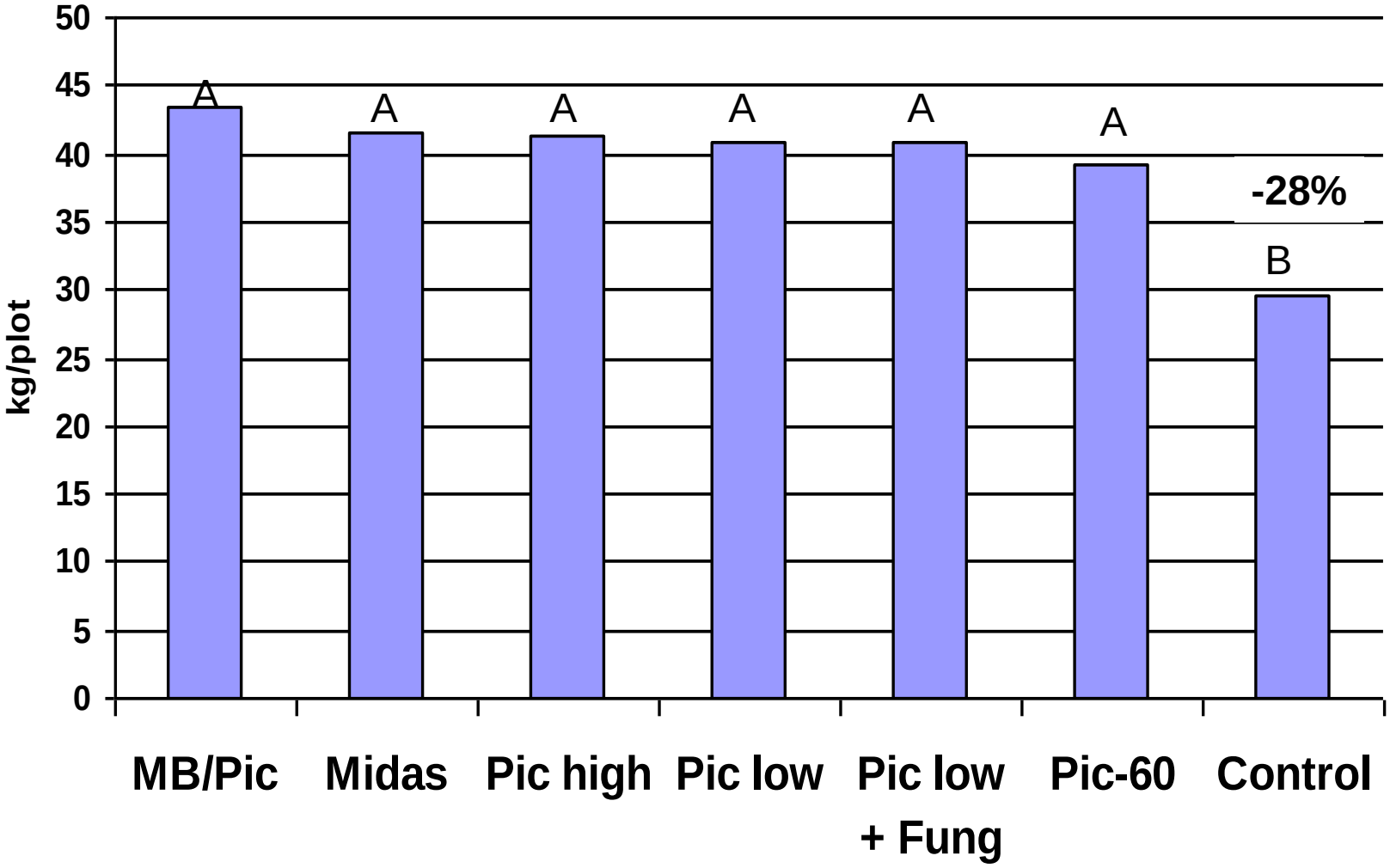
Vegetable and strawberry crop production

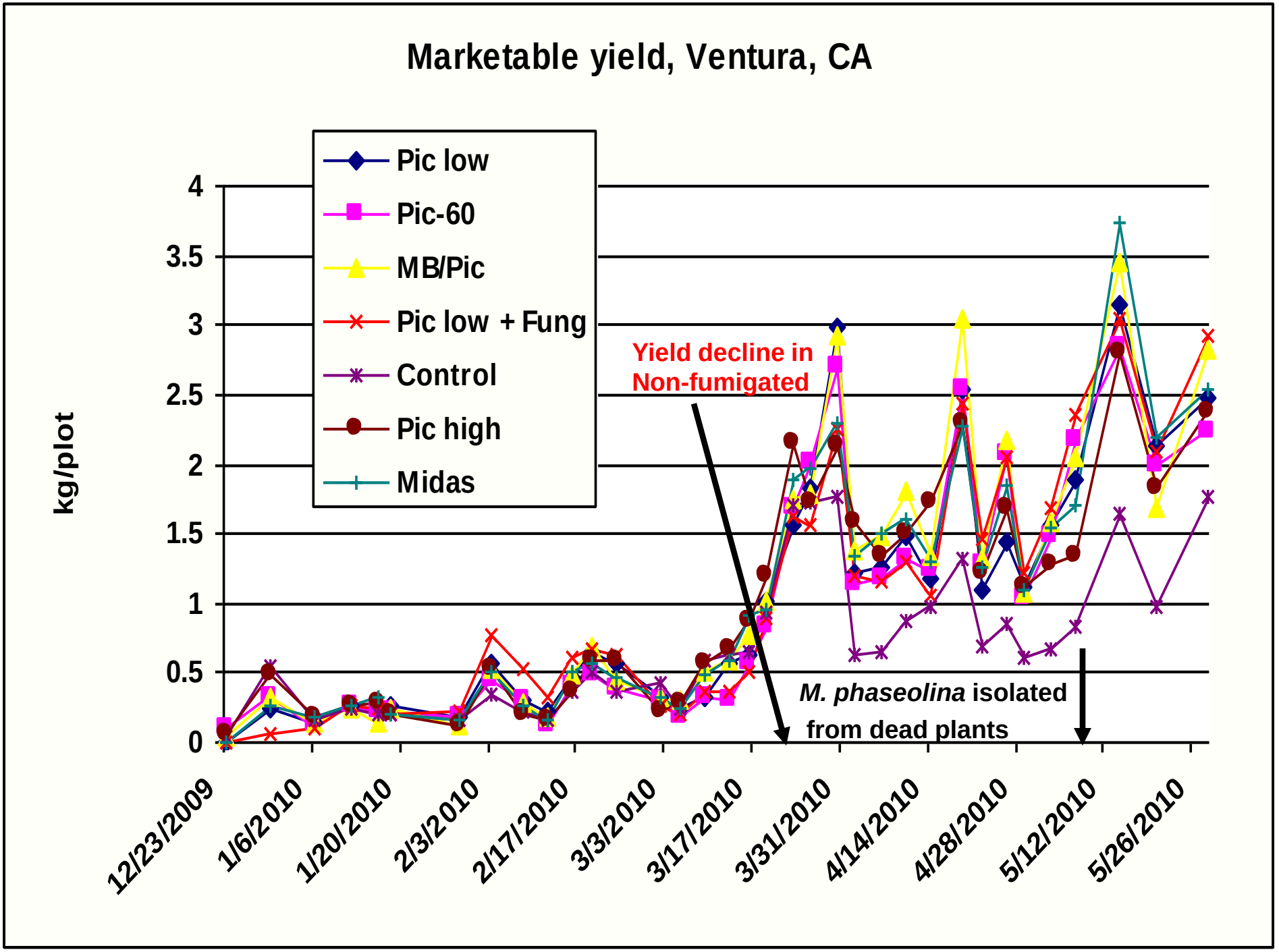
Strawberry

Recent Meetings

Fruit Yield, Ventura, 12/23/09-05/26/10

Camarosa, *M. phaseolina* isolated



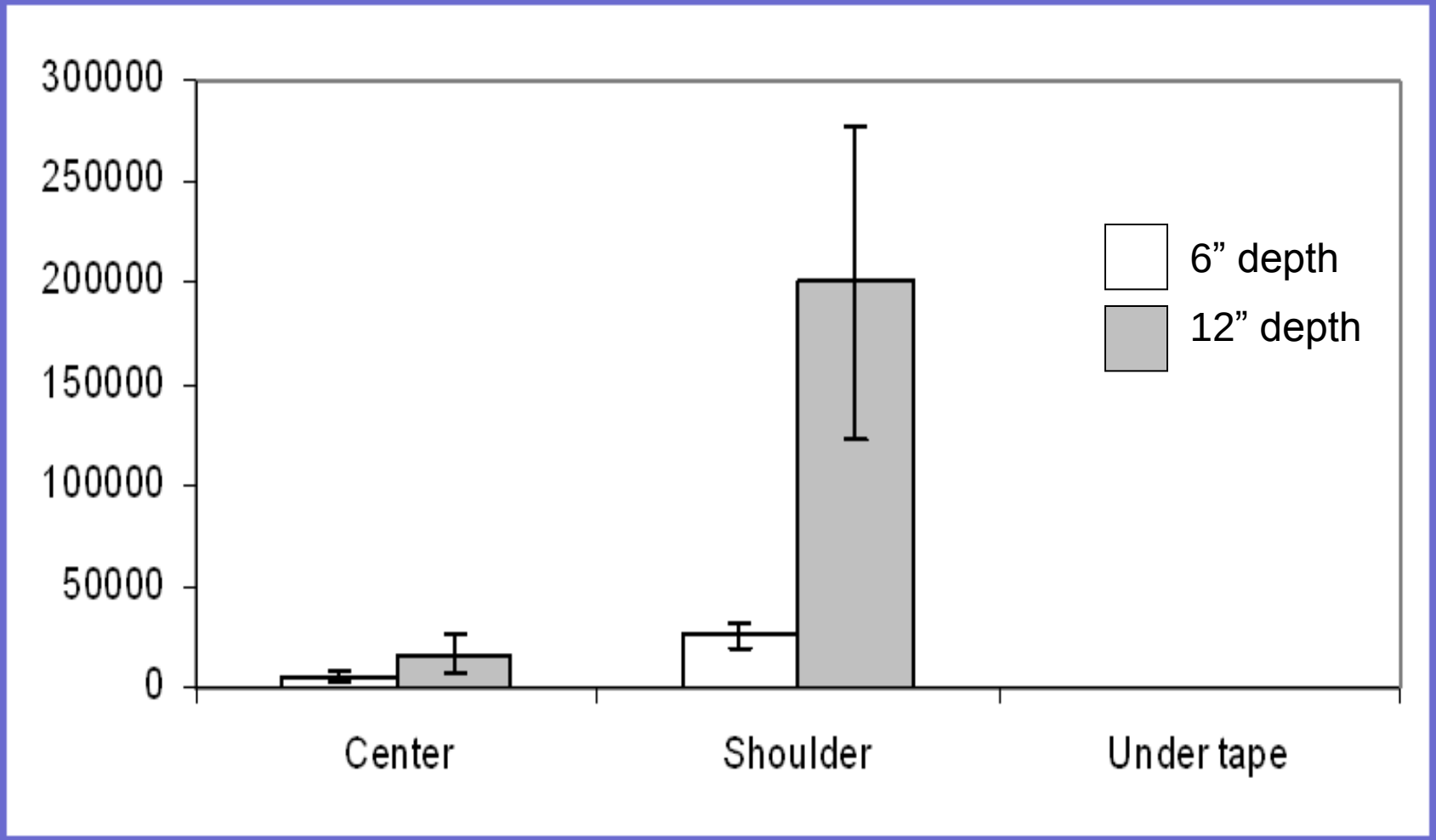

Marketable yield, Ventura, CA
Pic low
Pic-60
MB/Pic
Pic low + Fung
Control
Pic high
Midas
kg/plot
4
3.5
3
2.5
2
1.5
1
0.5
0
Yield decline in
Non-fumigated
M. phaseolina isolated
from dead plants
12/23/2009
1/6/2010
1/20/2010
2/3/2010
2/17/2010
3/3/2010
3/17/2010
3/31/2010
4/14/2010
4/28/2010
5/12/2010
5/26/2010

Drip fumigation : dieback on bed sides

- Less fumigant distributed?
- Dryer/greater stress?
- Root pruning aids infection?

Effect of depth on fumigant efficacy

Beds fumigated with Piclor-60



2011-12 season

New locations with Fusarium related die-back in Ventura county

Flat fumigated with 350lbs MB:PIC 50:50

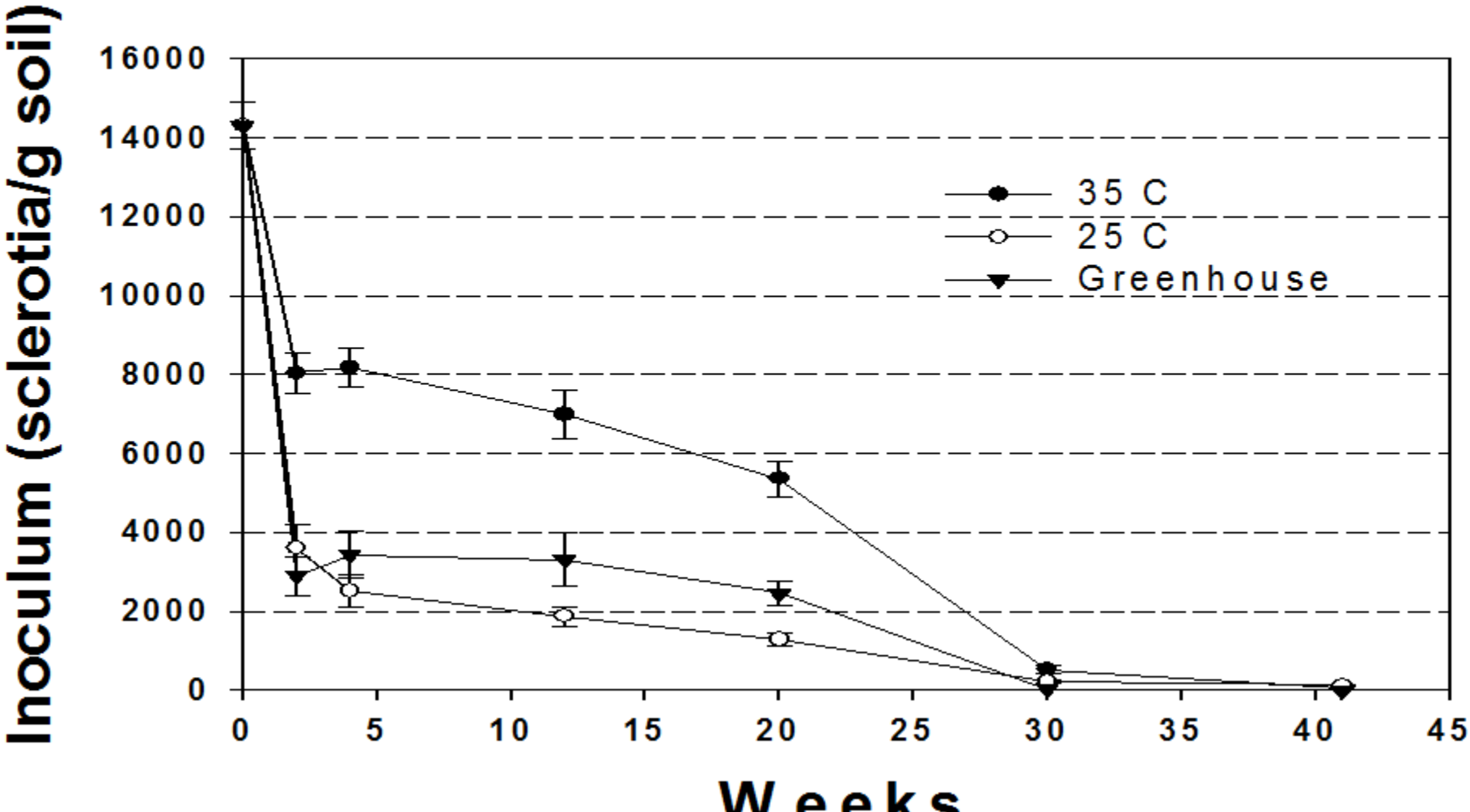
Survival of *Macrophomina* after fumigation in Israel

Freeman, et al.

Treatments	Crowns (%) at 30 cm
Control	**60 a**
MB 45lb/a	**10 b**
MS 40 lb/a	**5 b**
MS 70 lb/a	**5 b**
Chloropicrin 180 lb/a	**45 ab**
Chloropicrin 360 lb/a	**30 ab**

Survival of Macrophomina under different soil temperature regimes

Freeman, et al



Hosts of *M. phaseolina*
~ 500 plant species

Brassica spp. (Cabbage),
Capsicum annum (pepper),
Citrus spp.
Lycopersicon (tomato)
Cucumis spp. (cucumber)
Fragaria sp., (strawberry)
Many field crops
Most legumes
Weeds (malva, fleabane, etc.)

Hosts of *F.oxysporum* f. sp. *fragariae*

Fragaria sp., (strawberry)

What about our coastal vegetable crops hosting *M. phaseolina?*

so far we have not confirmed or seen M.p. infecting

brassicas, lettuce, spinach, celery, cilantro, endive/escarole, radicchio from Ventura, Santa Barbara, San Louis Obispo, Monterey, or Santa Cruz counties.

We did pick up M.p. on pepper once from Monterey county (Koike and Gordon, in-progress results)

M. phaseolina: review of 42 journal articles

- **Survives on dead tissue/residue, deep plowing/tillage minimal effect, removal/destruction suggested in 5 papers**

- **Sclerotia growth inhibited by antifungal antagonists *Trichoderma* and *Pseudomonas* spp. in lab**
- **Can grow sclerotia in very dry environment, optimum temp ~85-90F but region-adapted**

- **Sclerotia survival decreases with increase in soil moisture and carbon**
- **Can be seedborne without symptoms in beans**

- **Populations increase with continuous host cropping (2x for beans in 2 years) , long term rotations from hosts suggested**

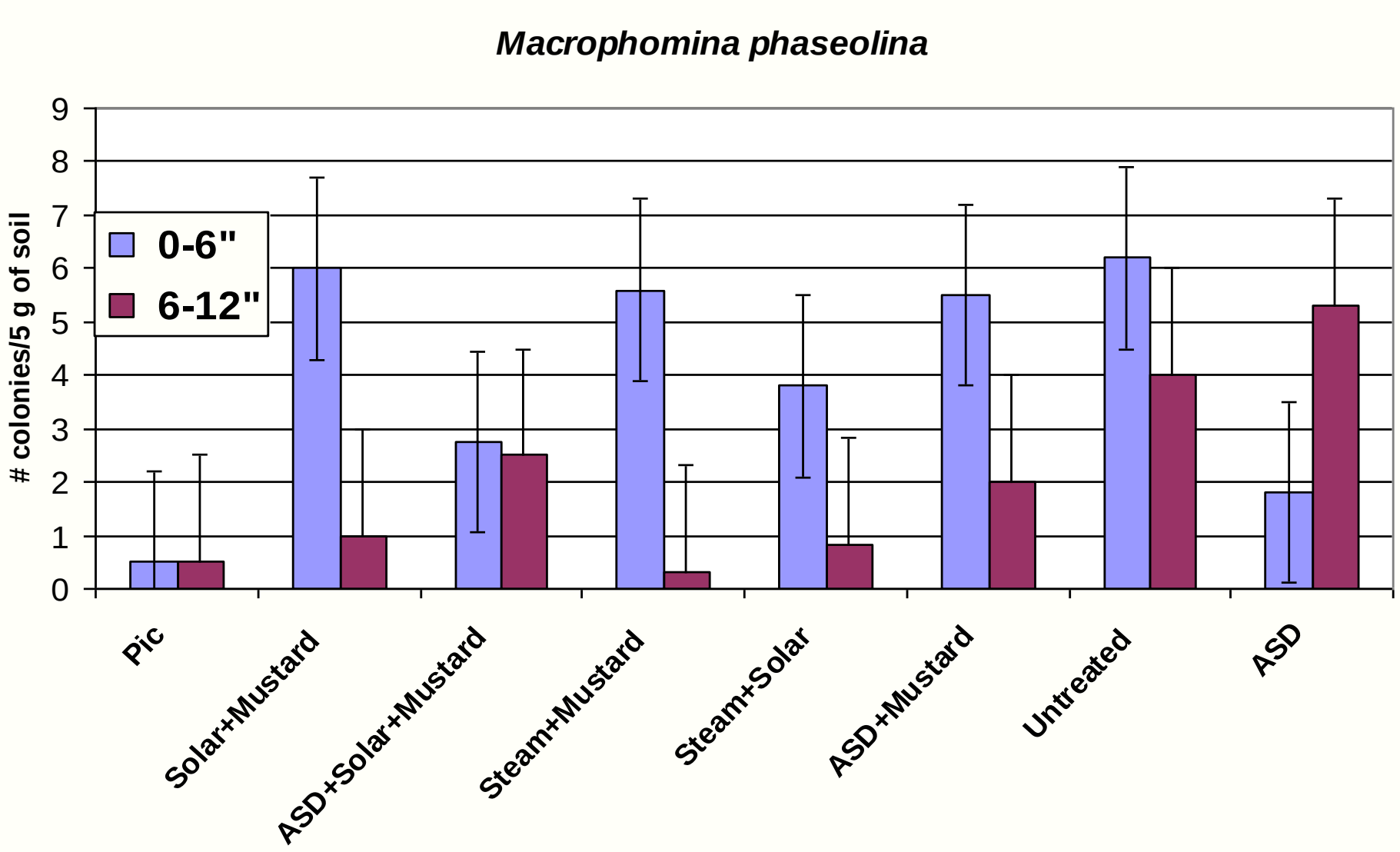
- **Fumigation (MBPic 325 lb/a) reduced sclerotia from 35 to 0-3 /g soil**

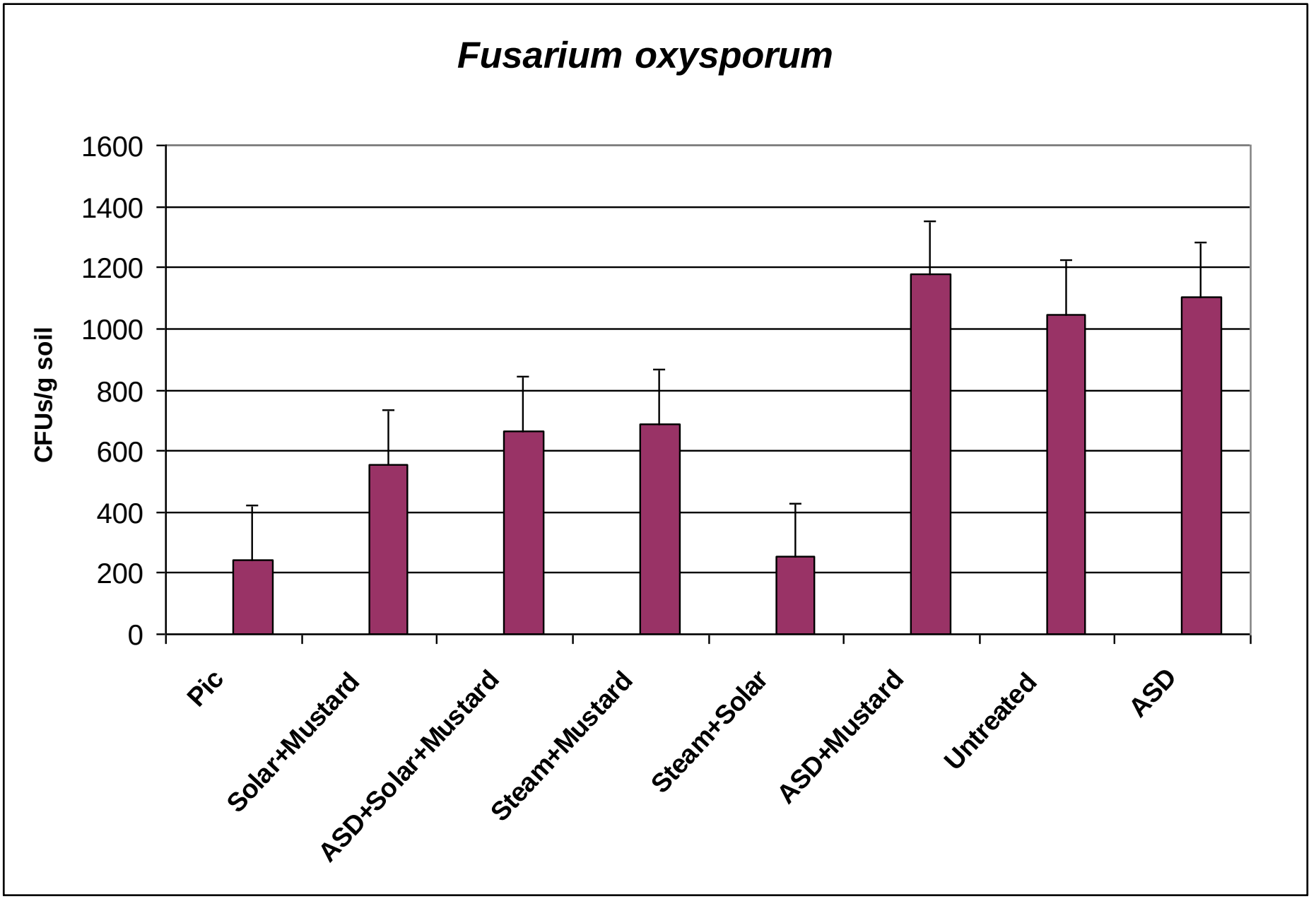
2011-12 season: buffer zone with both pathogens

ASD	**anaerobic soil disinfestation with rice bran (9 t/acre) + irrigation 3 acre-inches**
Solar	**clear mulch**
Mustard	**capsules of seed-meal at 2000 lbs/acre**
Steam	**injected to soil with spikes to raise temperature at 12” to 140F**
Pic	**chloropicrin at 300 lbs flat fumigated (non-randomized plots)**

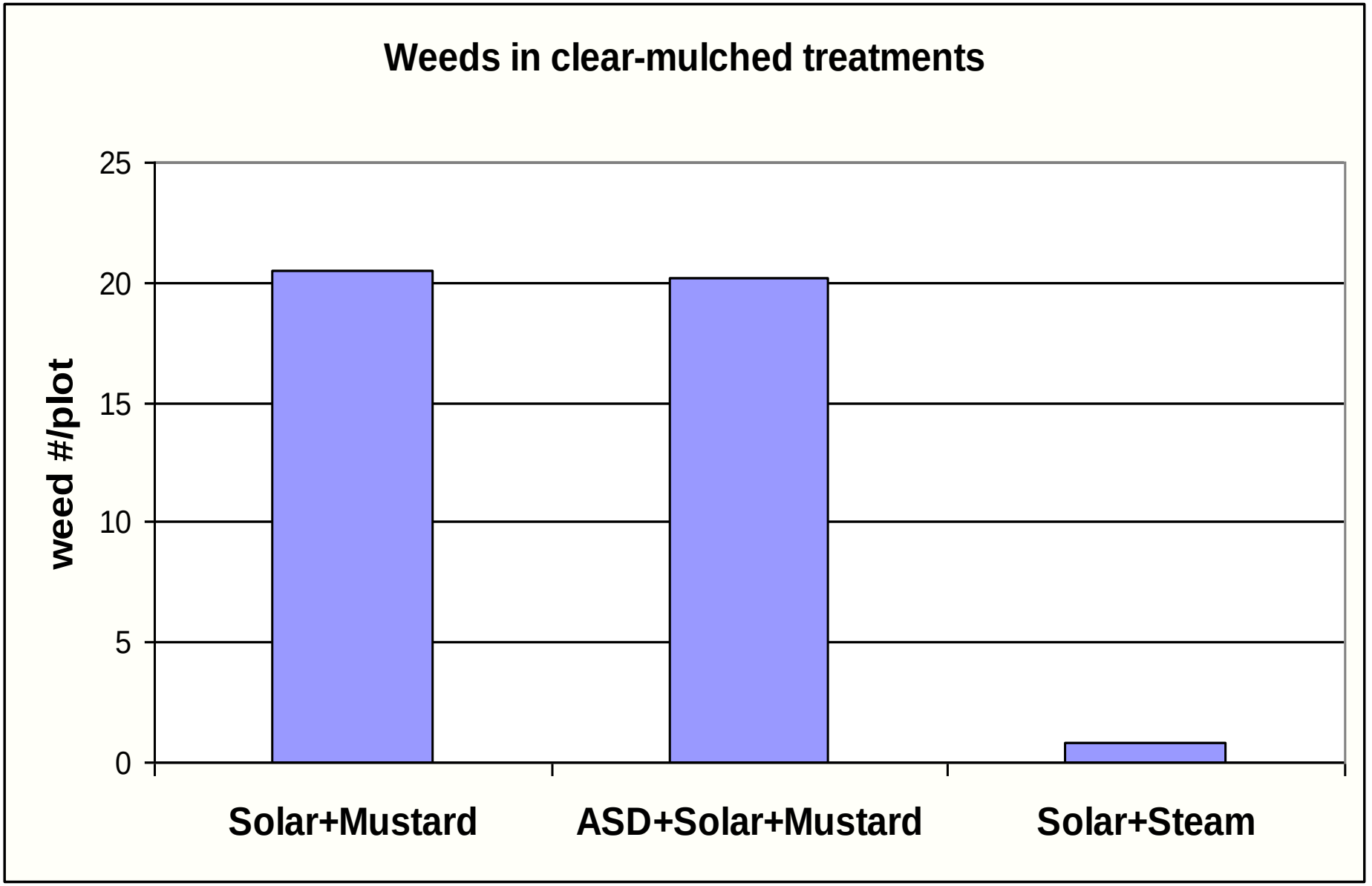
ASD and Mustard incorporation. We acknowledge José Romero and Hector Gutierrez for letting us use the mixer-shaper

Steam application


Macrophomina phaseolina
colonies/5 g of soil
0
1
2
3
4
5
6
7
8
9
0-6"
6-12"
Pic
Solar+Mustard
ASD+Solar+Mustard
Steam+Mustard
Steam+Solar
ASD+Mustard
Untreated
ASD



No significant effect of depth: 0-6” = 6-12”


Weeds in clear-mulched treatments
weed #/plot
25
20
15
10
5
0
Solar+Mustard
ASD+Solar+Mustard
Solar+Steam

ASD+ Mustard

Steam+ Mustard

Dec 29. 2011

Mustard + Solar

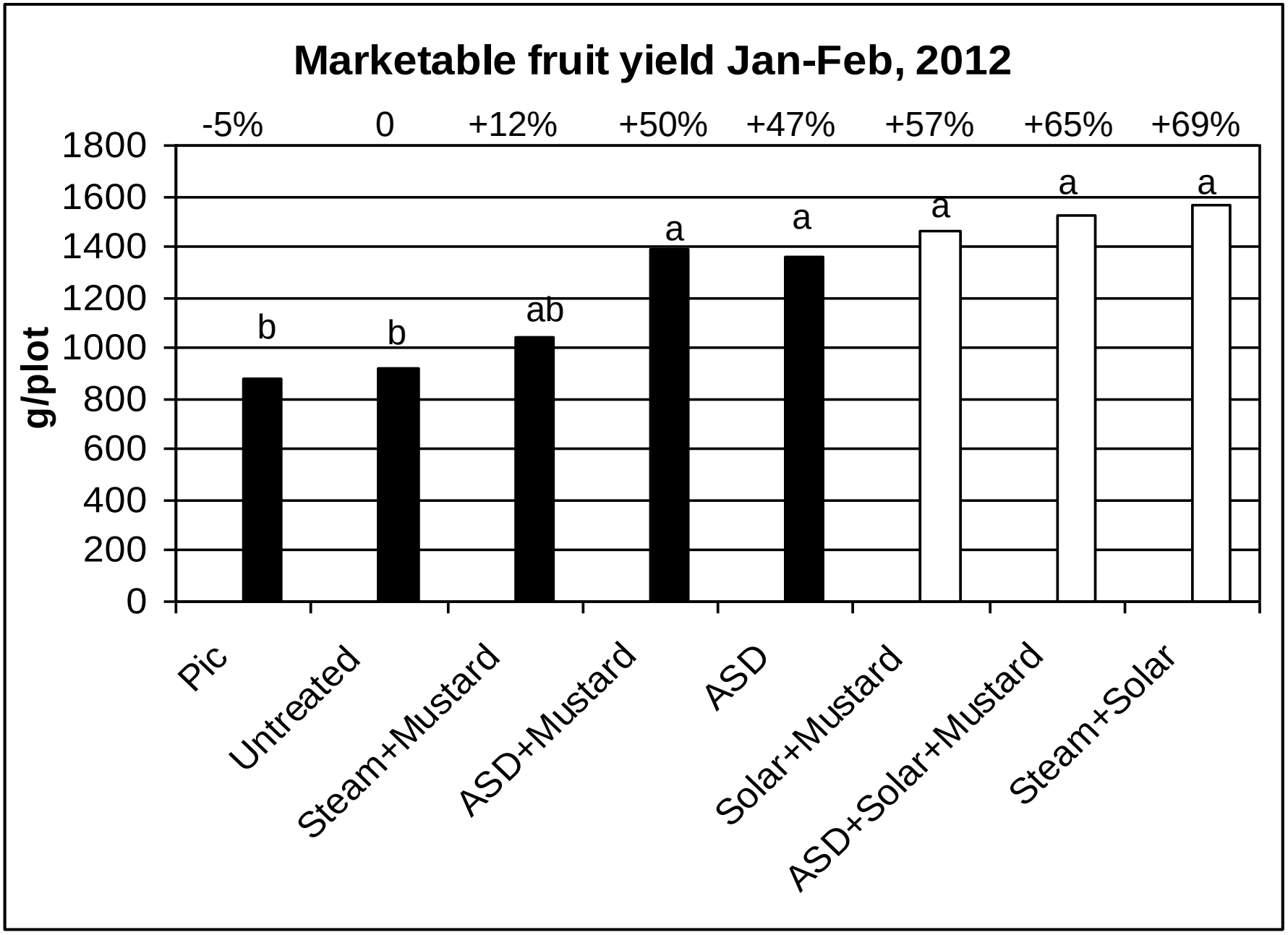
ASD + Mustard + Solar

Dec 29. 2012

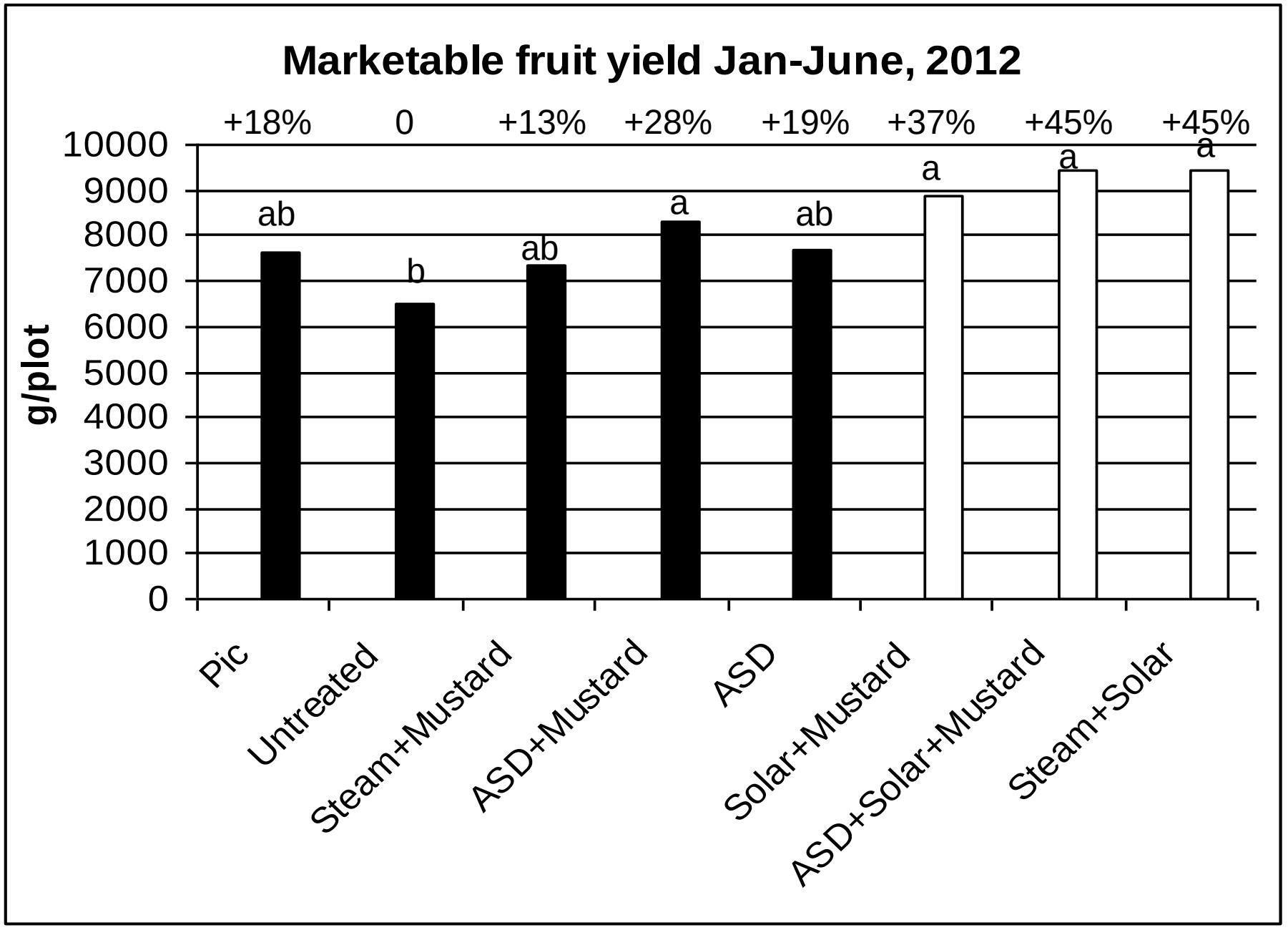
Pic 300

Untreated

Dec 29. 2012



Treatments with the same letter are statistically similar (*P*=0.05)



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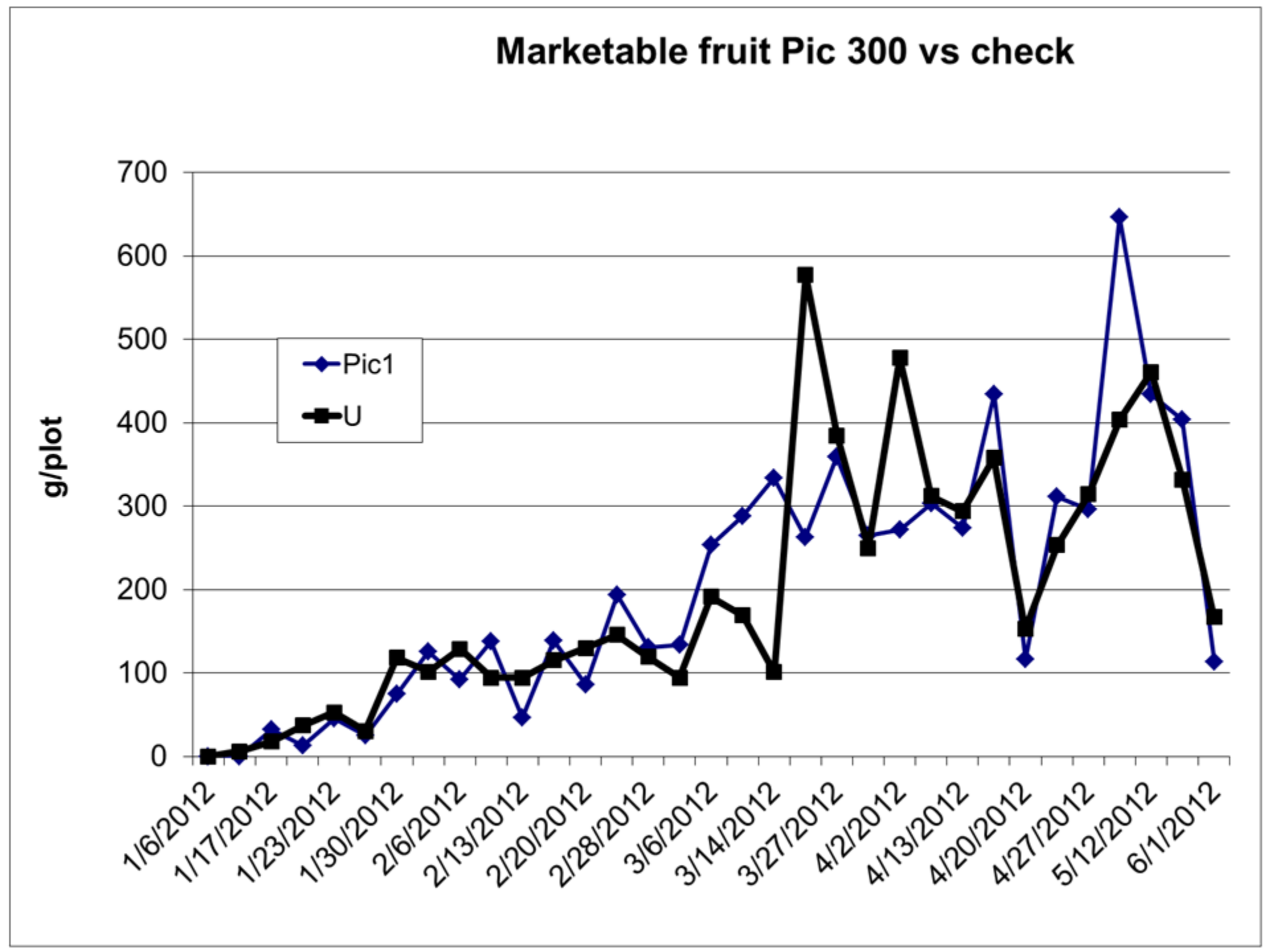
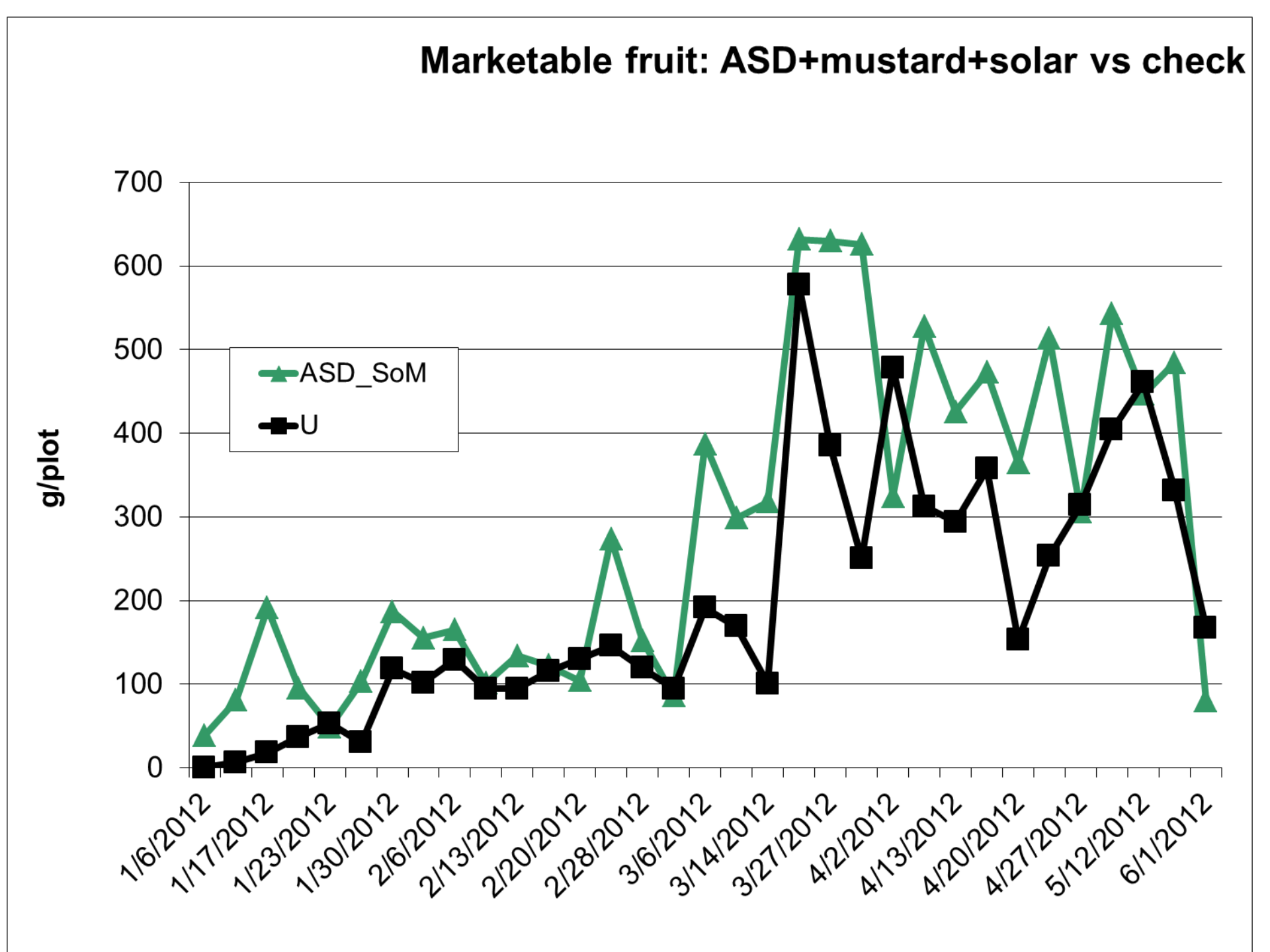

Marketable fruit Pic 300 vs check
g/plot
700
600
500
400
300
200
100
0
Pic1
U
1/6/2012
1/17/2012
1/23/2012
1/30/2012
2/6/2012
2/13/2012
2/20/2012
2/28/2012
3/6/2012
3/14/2012
3/27/2012
4/2/2012
4/13/2012
4/20/2012
4/27/2012
5/12/2012
6/1/2012


Marketable fruit: ASD+mustard+solar vs check
g/plot
700
600
500
400
300
200
100
0
ASD_SoM
U
1/6/2012
1/17/2012
1/23/2012
1/30/2012
2/6/2012
2/13/2012
2/20/2012
2/28/2012
3/6/2012
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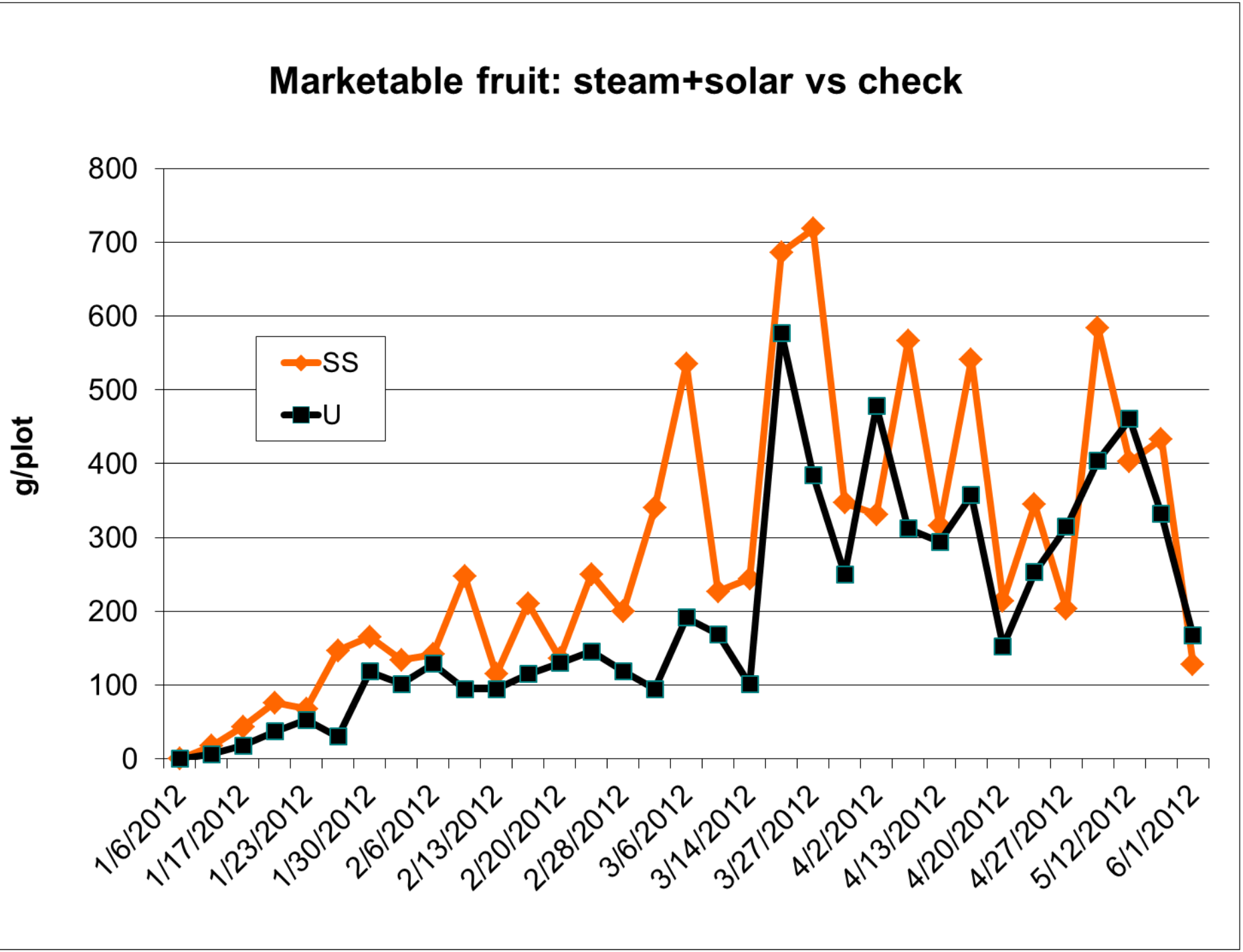
4/13/2012
4/20/2012
4/27/2012
5/12/2012
6/1/2012


Marketable fruit: steam+solar vs check
g/plot
800
700
600
500
400
300
200
100
0
SS
U
1/6/2012
1/17/2012
1/23/2012
1/30/2012
2/6/2012
2/13/2012
2/20/2012
2/28/2012
3/6/2012
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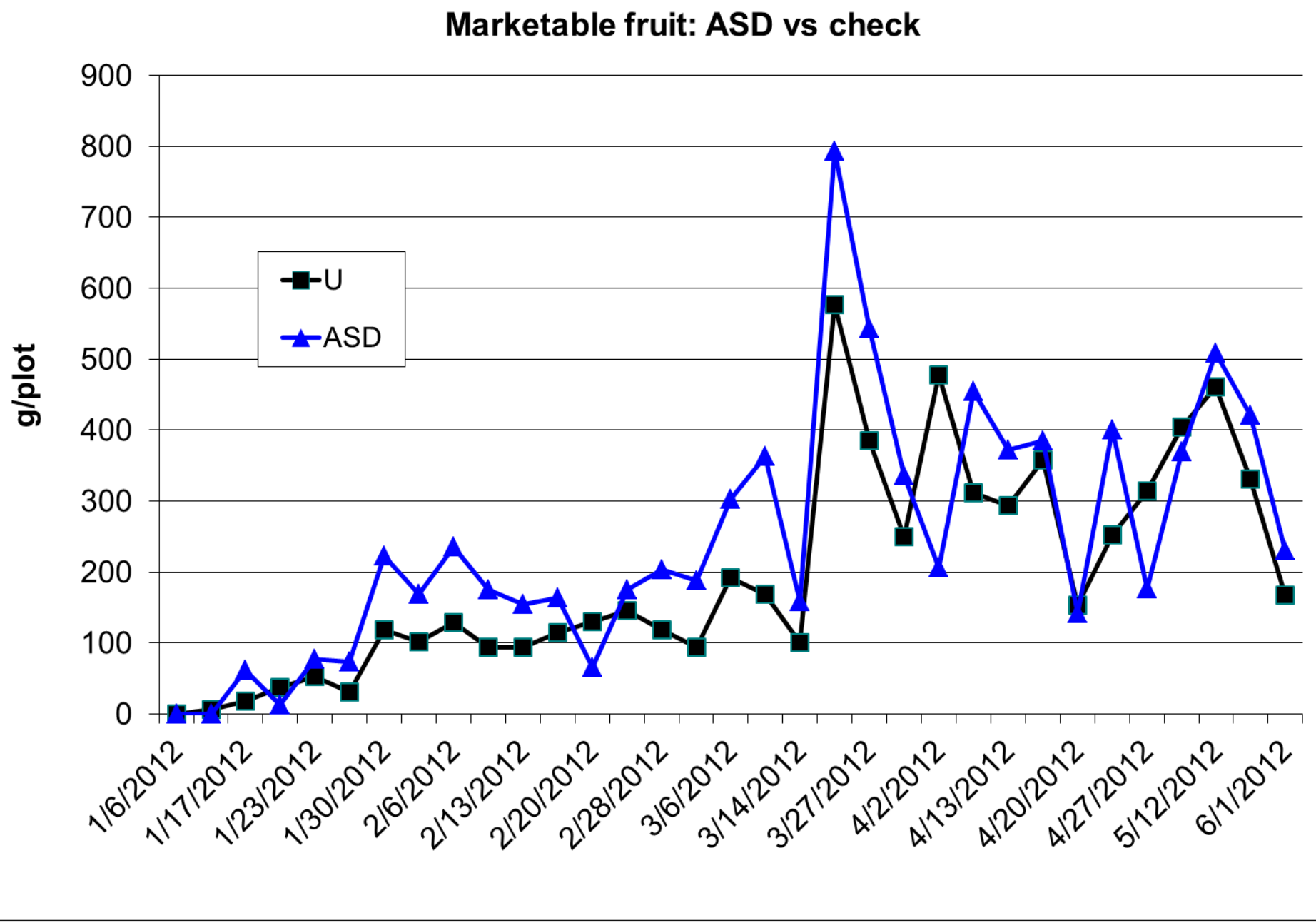
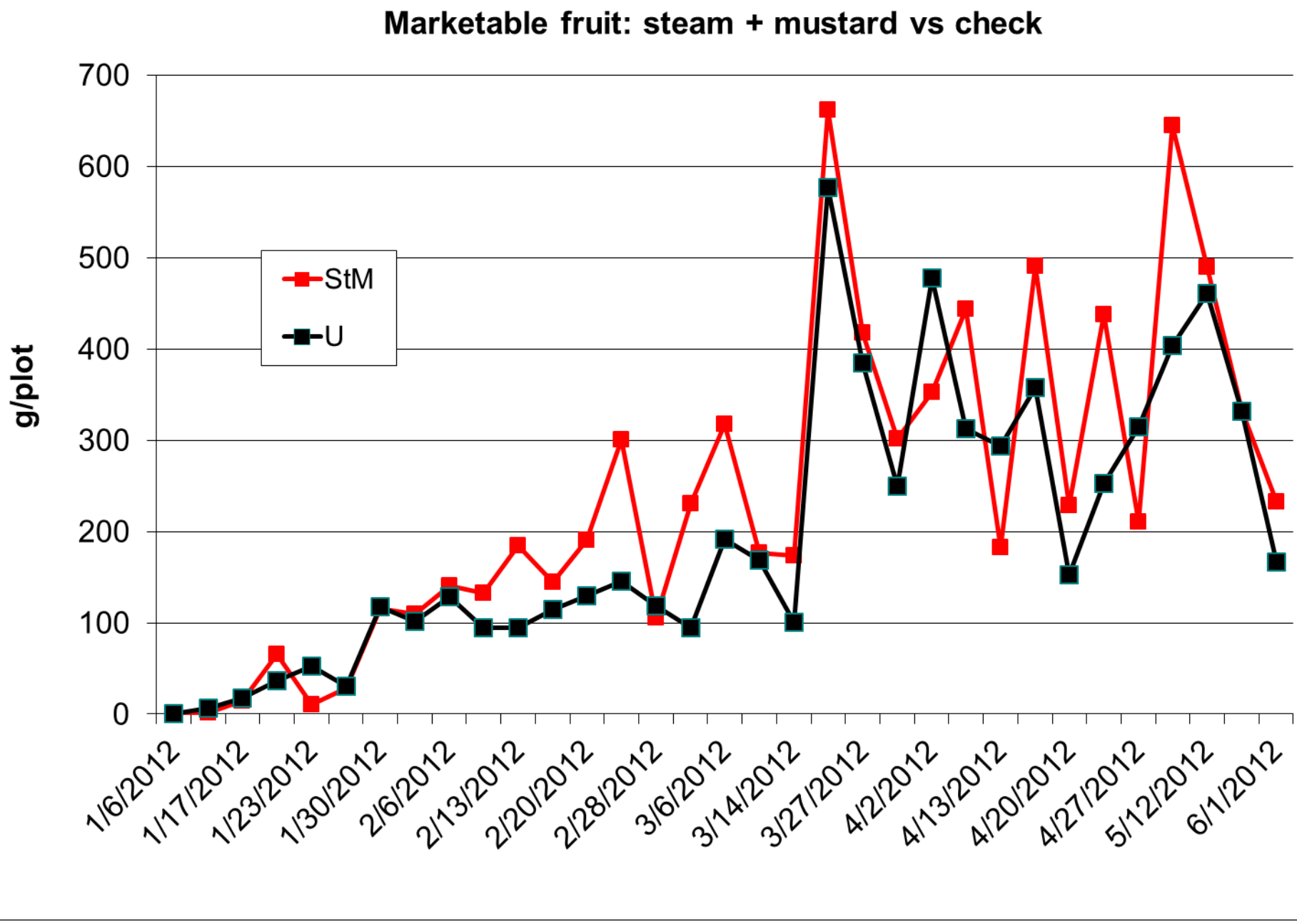
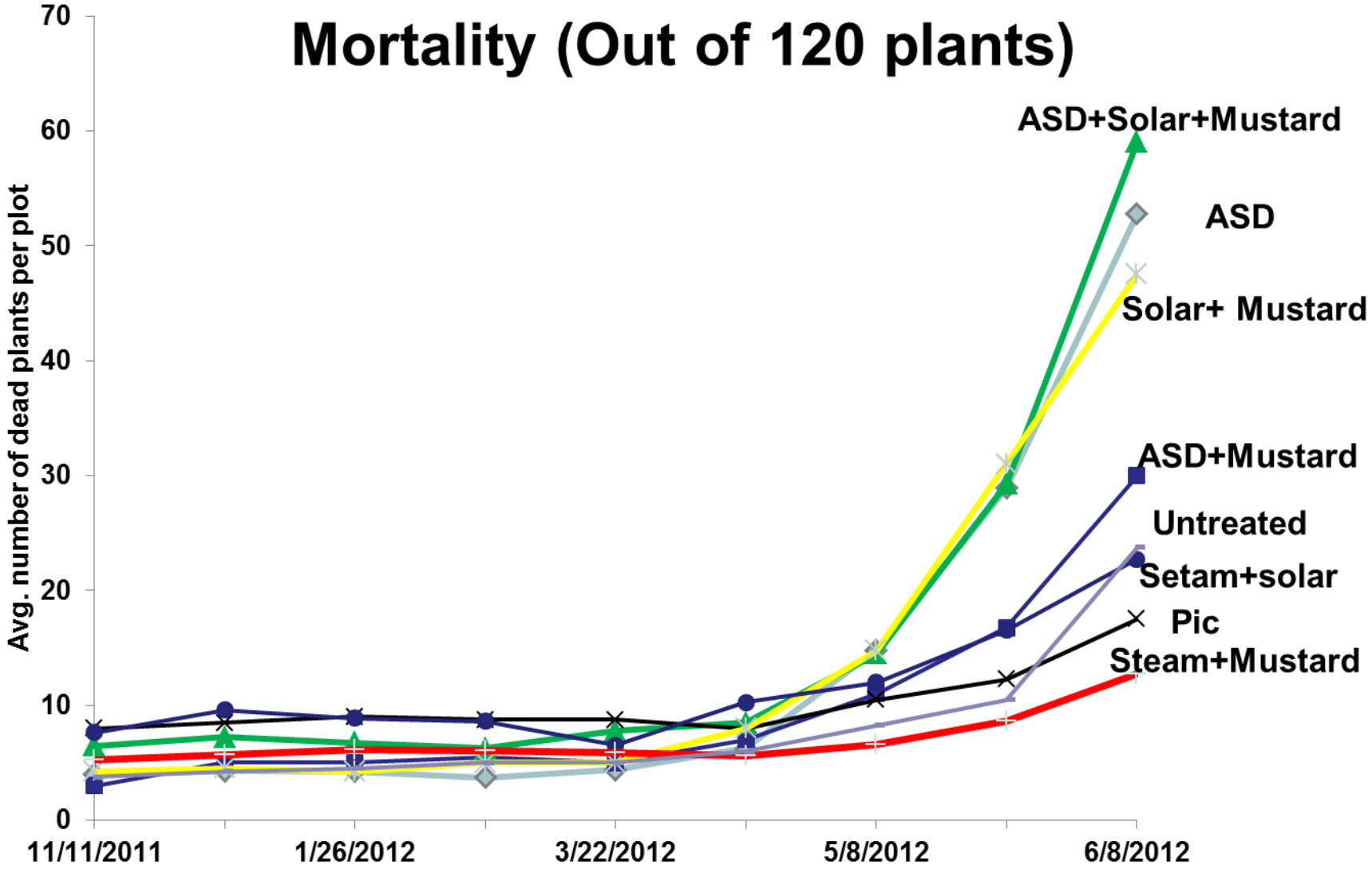
4/20/2012
4/27/2012
5/12/2012
6/1/2012


Marketable fruit: ASD vs check
g/plot
900
800
700
600
500
400
300
200
100
0
U
ASD
1/6/2012
1/17/2012
1/23/2012
1/30/2012
2/6/2012
2/13/2012
2/20/2012
2/28/2012
3/6/2012
3/14/2012
3/27/2012
4/2/2012
4/13/2012
4/20/2012
4/27/2012
5/12/2012
6/1/2012


Marketable fruit: steam + mustard vs check
g/plot
700
600
500
400
300
200
100
0
StM
U
1/6/2012
1/17/2012
1/23/2012
1/30/2012
2/6/2012
2/13/2012
2/20/2012
2/28/2012
3/6/2012
3/14/2012
3/27/2012
4/2/2012
4/13/2012
4/20/2012
4/27/2012
5/12/2012
6/1/2012


Mortality (Out of 120 plants)
Avg. number of dead plants per plot
70
60
50
40
30
20
10
0
11/11/2011
1/26/2012
3/22/2012
5/8/2012
6/8/2012
ASD+Solar+Mustard
ASD
Solar+ Mustard
ASD+Mustard
Untreated
Setam+solar
Pic
Steam+Mustard

	% DEAD on June 8th
Steam + Mustard	6.4
Pic	7.8
Steam + Solar	13.2
Untreated	17.2
ASD + Mustard	23.0
Solar + Mustard	37.7
ASD	42.1
ASD + Solar + Mustard	45.9

ASD+Mustard

Steam + Mustard

June 8. 2012

Mustard+Solar

ASD + Mustard + Solar

June 8. 2012

Pic 300

Untreated

June 8. 2012

Macrophomina and Fusarium

Fumigants

- Effective when in contact with pathogens
- Repeated flat fumigation = gradual elimination of inoculum ?

Non-fumigant treatments

- Work in progress, only steam reduced pathogen levels

Acknowledgements

- Terry Farms for hosting field trials
- Juan Hernandez and the Mandalay Berry Farms for bedding crew for help in setting up the treatments
- Hector Gutierrez and Jose Romero for assistance with equipment.
- Krishna Subbarao (laboratory assistance) Andrew Weimers (organizing the field day)