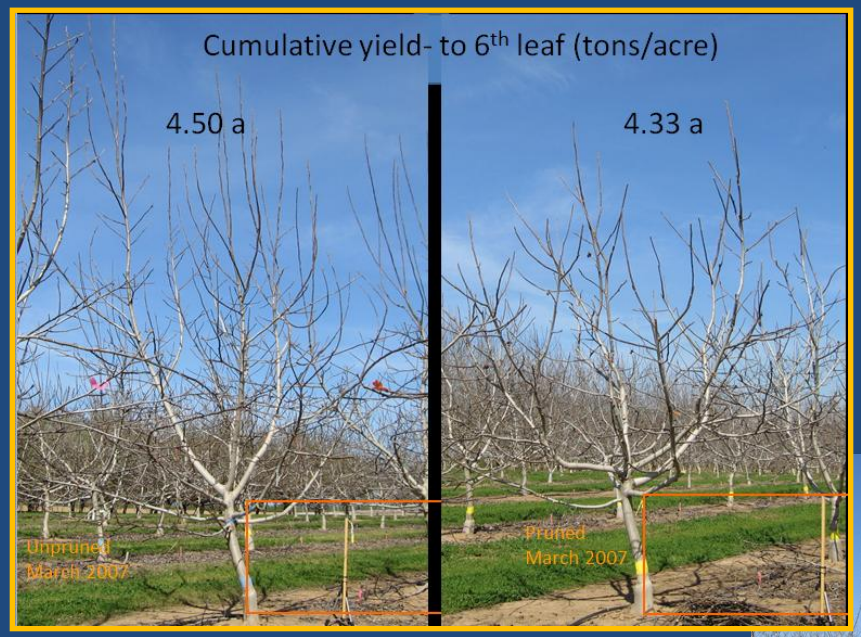
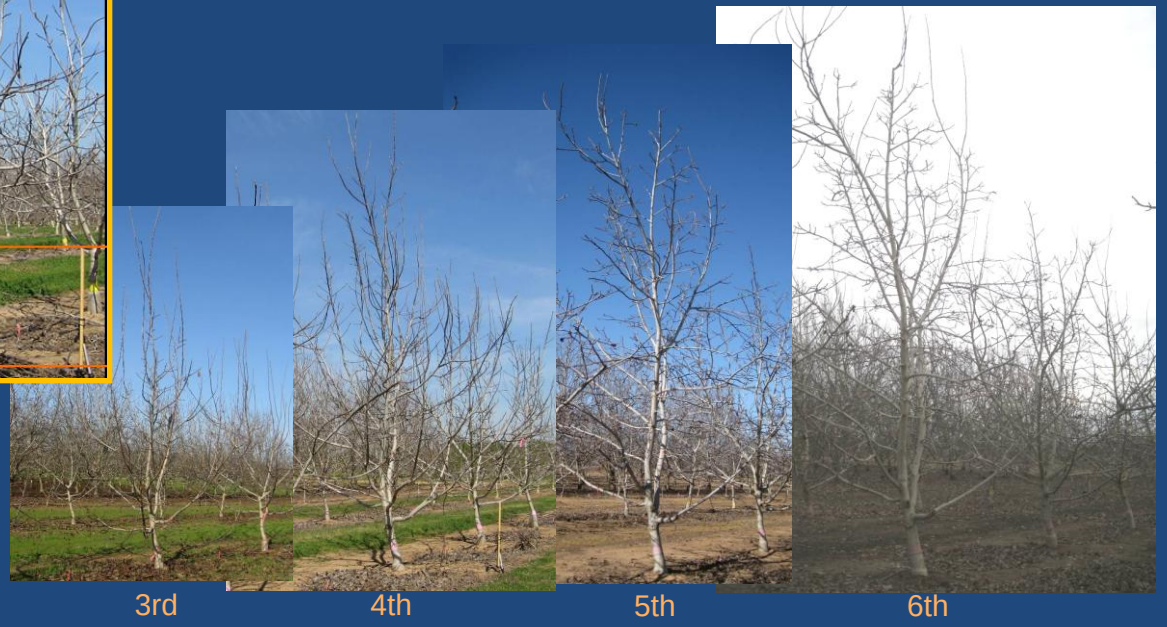
Canopy Management in Walnut during Training Years 1-7

Bruce Lampinen
UC Davis Plant Sciences





Pruned versus unpruned trials during canopy development phase

- Howard pruned versus unpruned trial
  - Nickels Soil Lab 2003-2009
- Chandler pruned versus unpruned trial
  - Nickels Soil Lab 2008-2013 (ongoing)

Other pruned versus unpruned trials initiated around state

Height of heading at planting trial

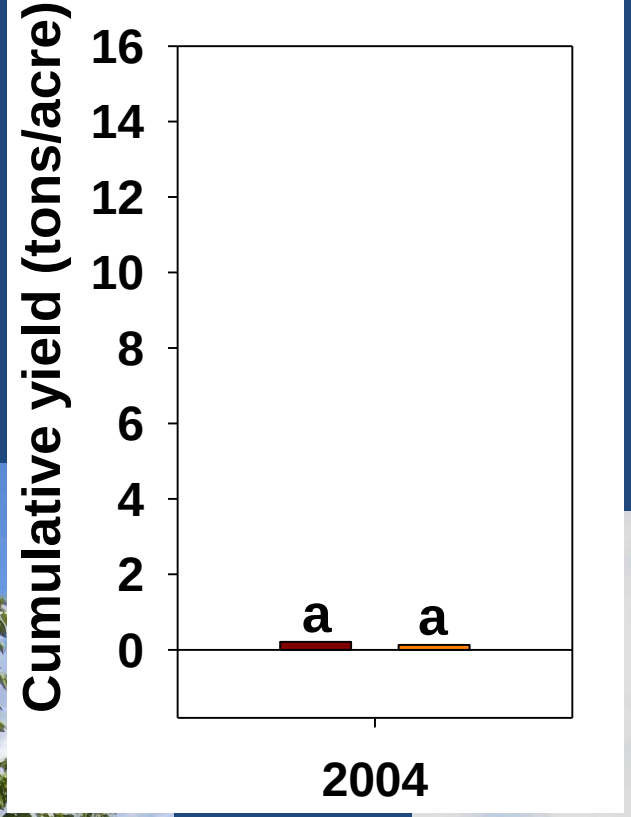
Howard Pruning treatments imposed in March 2004- after scaffold selection following second growing season

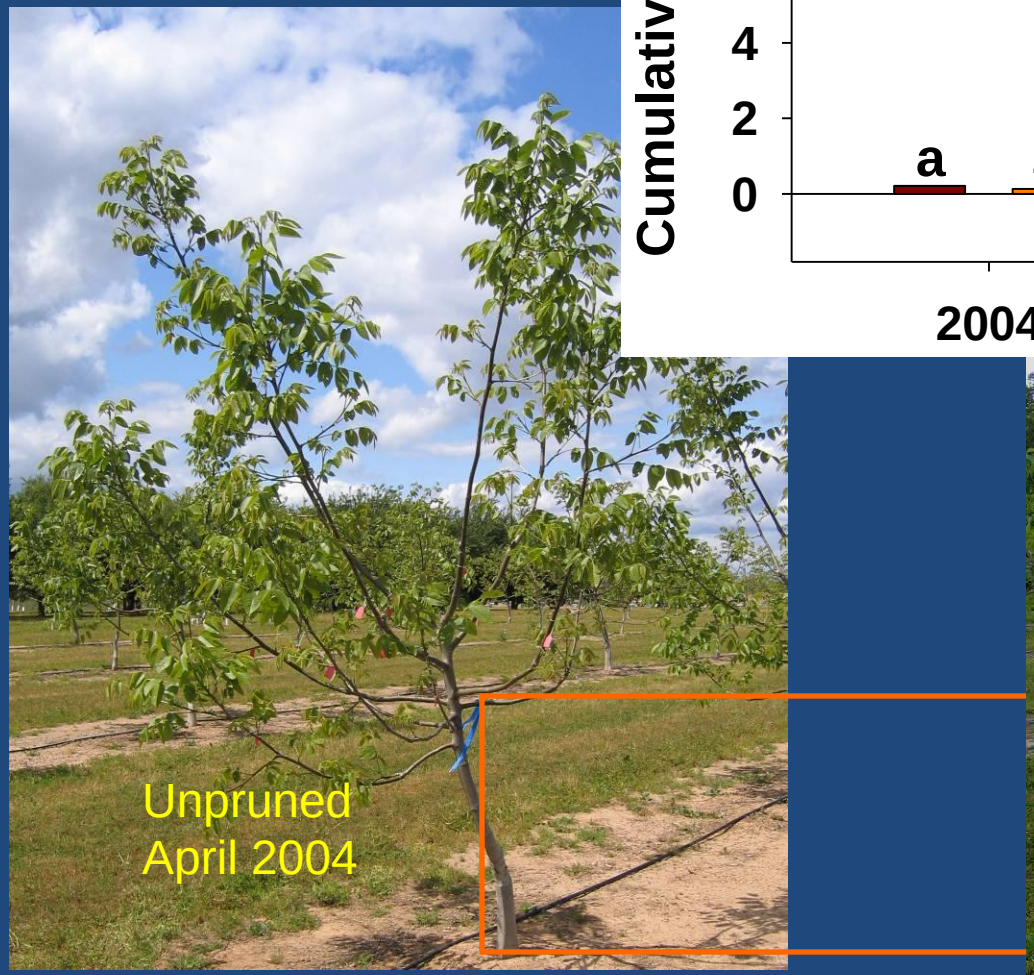
12’ x 25’ spacing (145 trees/acre)

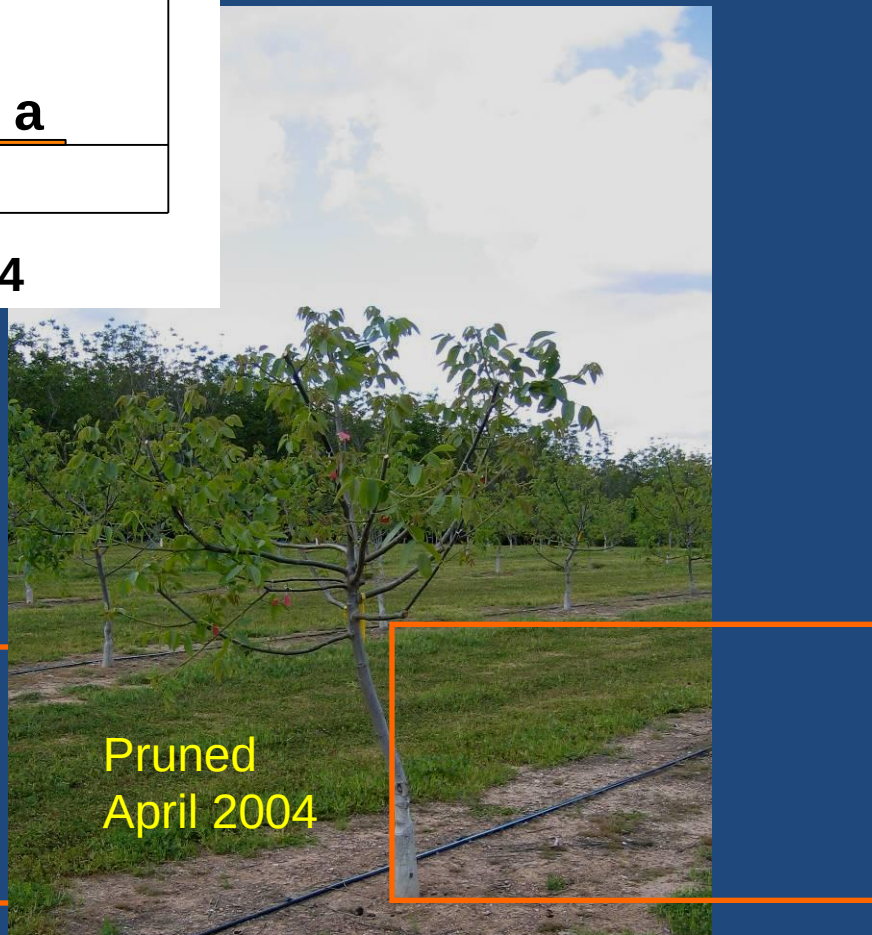
Unpruned after scaffold selection

Pruned (1/3 of previous year growth each year until tree fills allotted space)

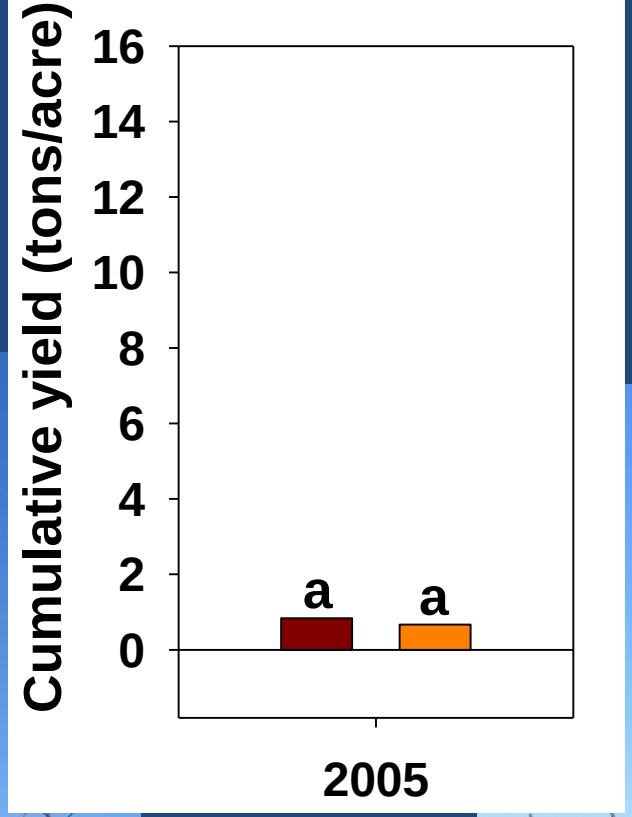
April 2004

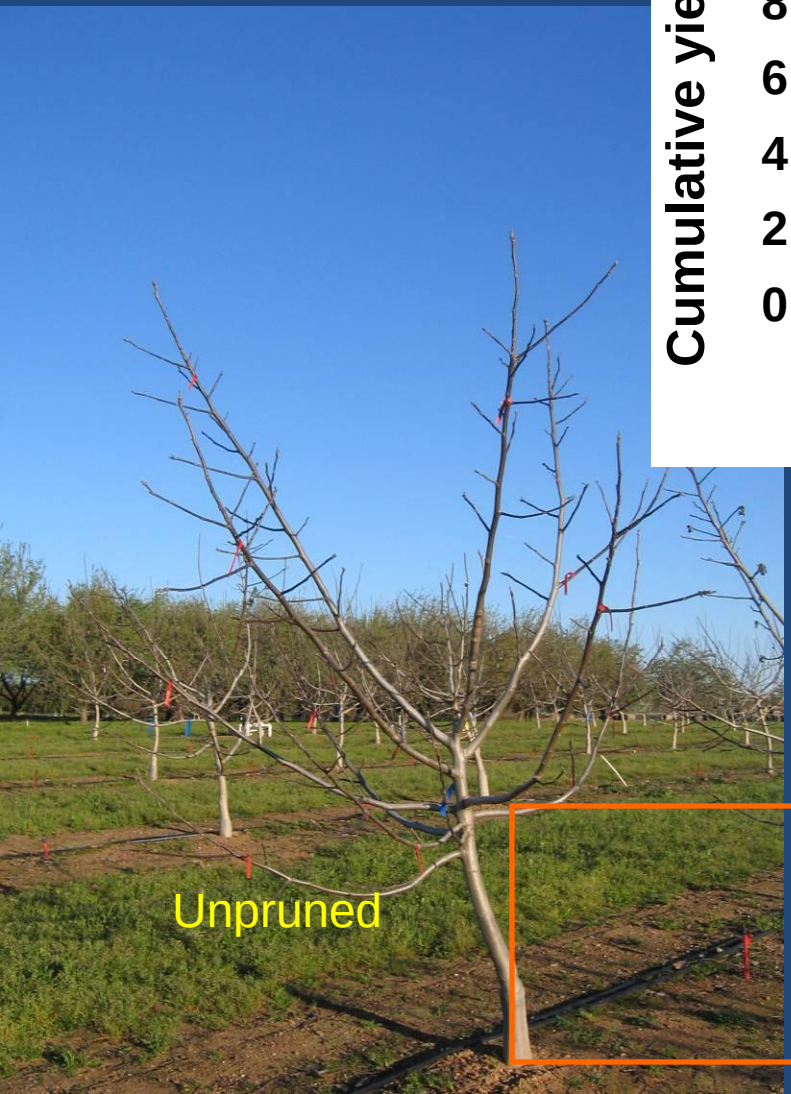

Cumulative yield (tons/acre)
16
14
12
10
8
6
4
2
0
a
a
2004


Unpruned
April 2004


Pruned
April 2004

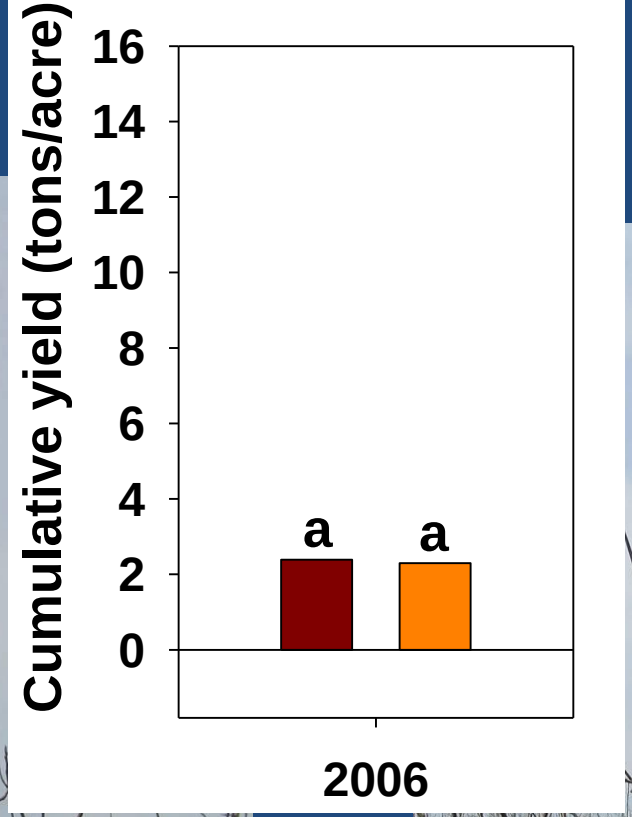
March 2005


Cumulative yield (tons/acre)
16
14
12
10
8
6
4
2
0
a
a
2005


Unpruned


Pruned

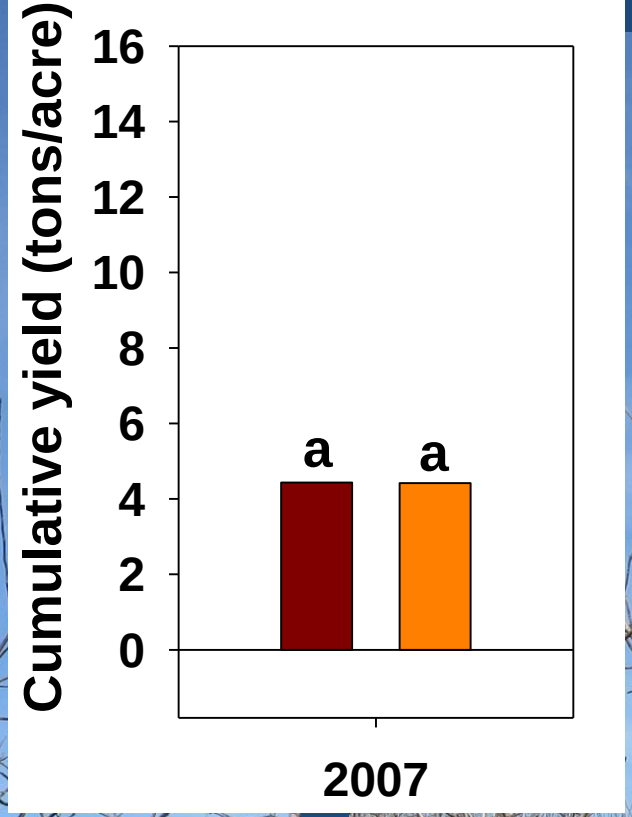
March 2006


Cumulative yield (tons/acre)
16
14
12
10
8
6
4
2
0
a
a
2006


Unpruned

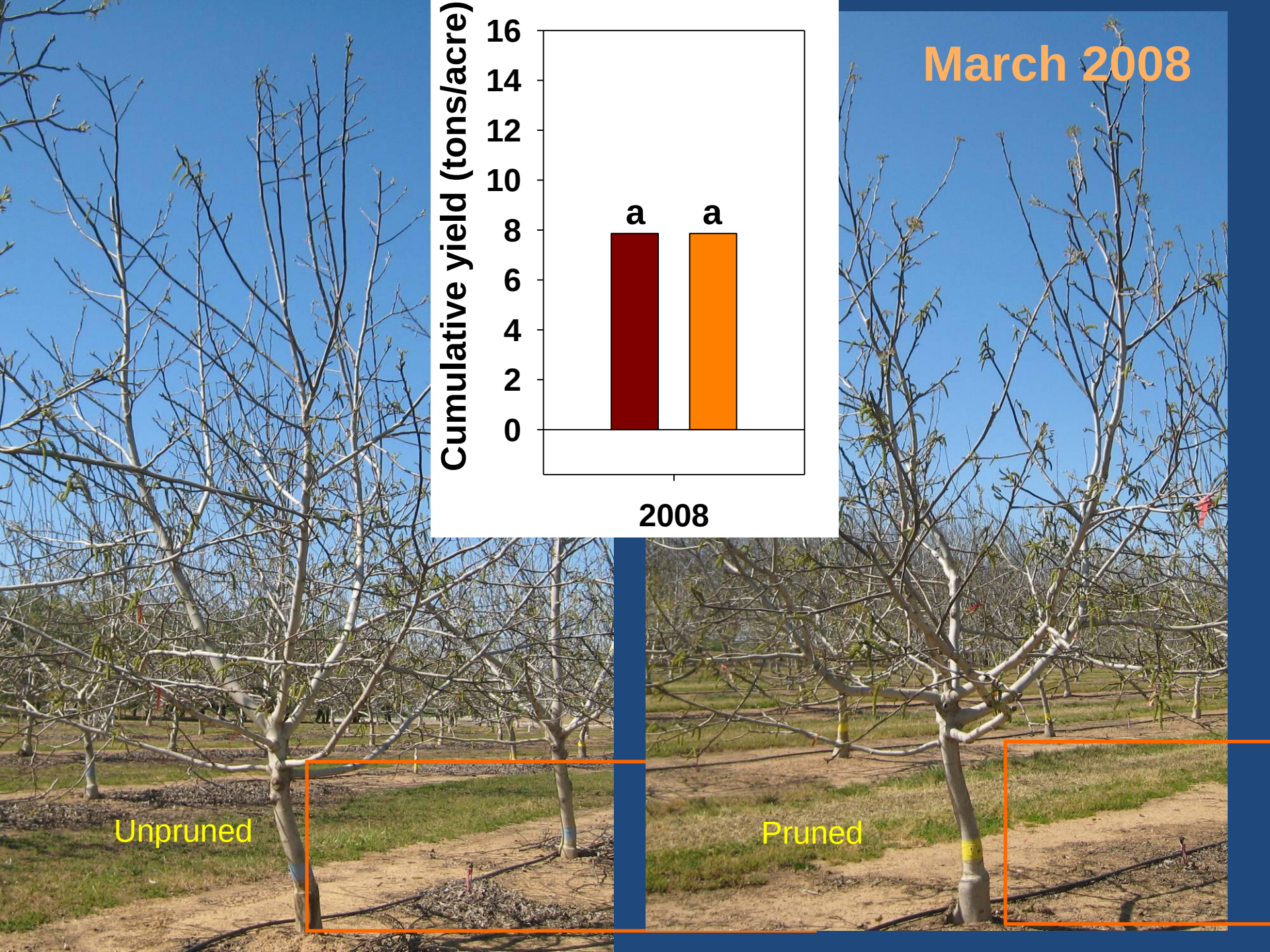

Pruned

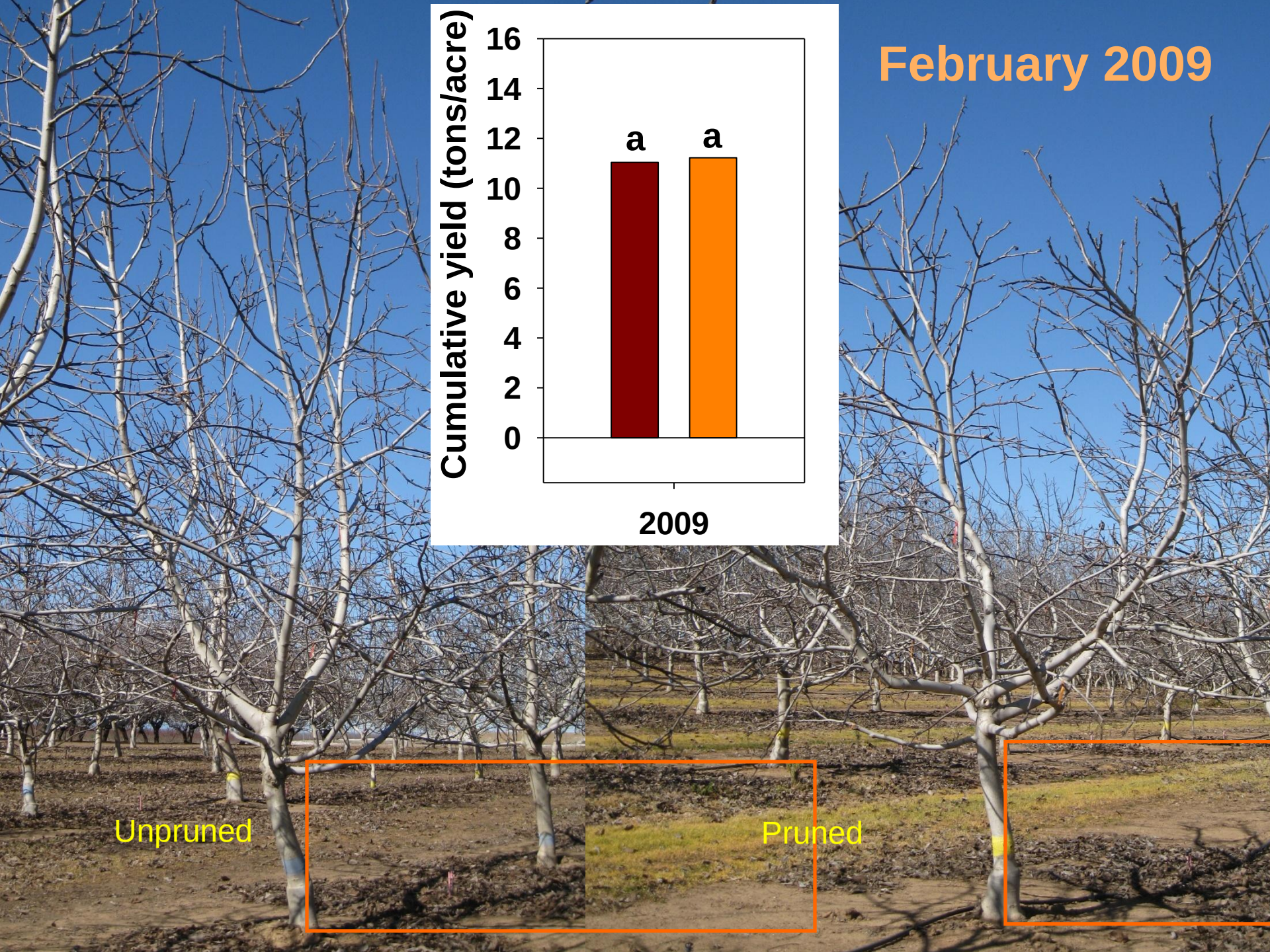
March 2007



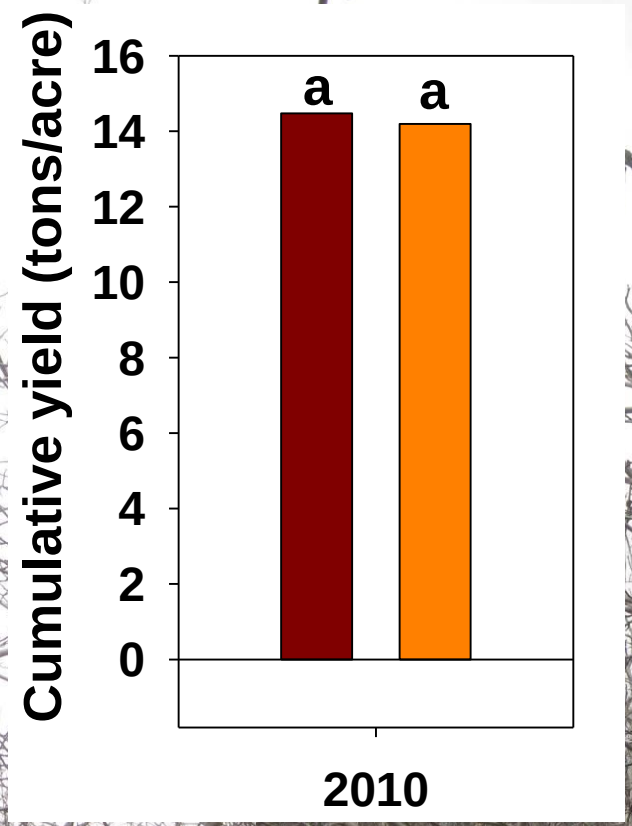
Unpruned

Pruned


March 2008
Cumulative yield (tons/acre)
16
14
12
10
8
6
4
2
0
a
a
2008
Unpruned
Pruned


February 2009
Cumulative yield (tons/acre)
16
14
12
10
8
6
4
2
0
a
a
2009
Unpruned
Pruned

Jan. 2010



Unpruned

Pruned

Howard pruned versus unpruned trial

After 8 years of treatment imposition, no benefits to pruning

Chandler pruned versus unpruned trial

- Chandler orchard planted at 15 x 22 ft.
- Planted 2008
- Nursery budded on Paradox rootstock
- March 2009 pruning treatments imposed
- Treatments
  - Heavily pruned
  - Minimally pruned
  - No heading/no pruning

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Chandler pruned versus unpruned trial

Chandler orchard planted at 15 x 22 ft.

Planted 2008

Nursery budded on Paradox rootstock

March 2009 pruning treatments imposed

Treatments

- Heavily pruned
- Minimally pruned
- No heading/no pruning

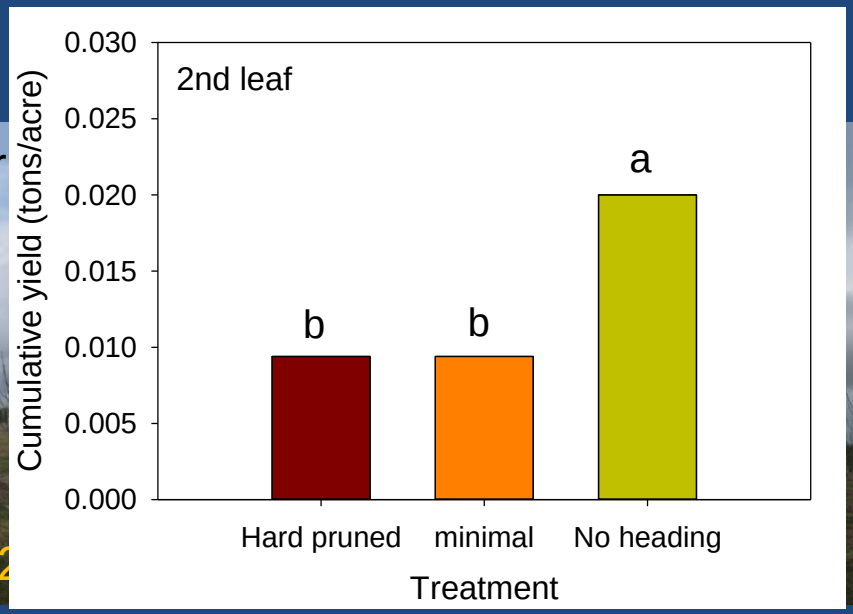
After first growing season

Before pruning

After pruning

After second growing season

Before pruning



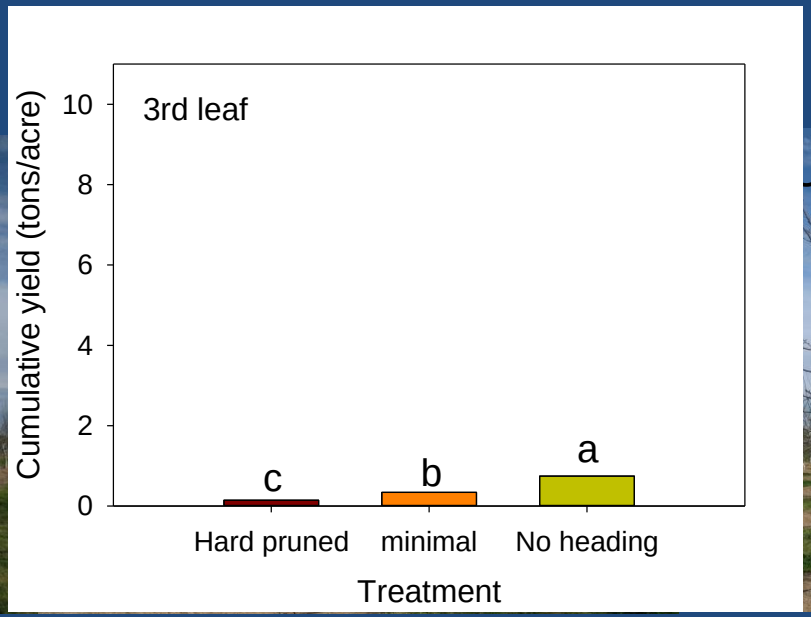
After second growing season

Before pruning

After pruning

After third growing season

Before pruning



After third growing season

Before pruning

Before pruning

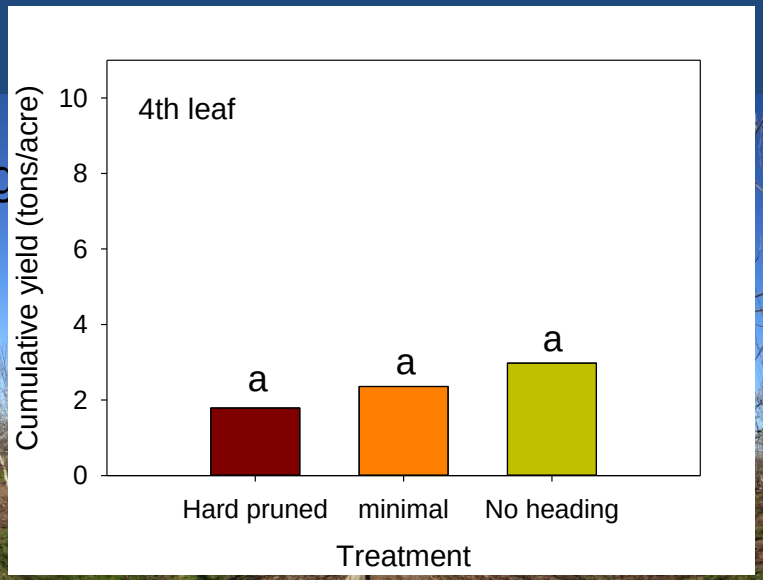
12/30/12

12/30/12

12/30/12

After fourth growing season

Before pruning



12/30/12

12/30/12

12/30/12

After fourth growing season

Heavy pruning

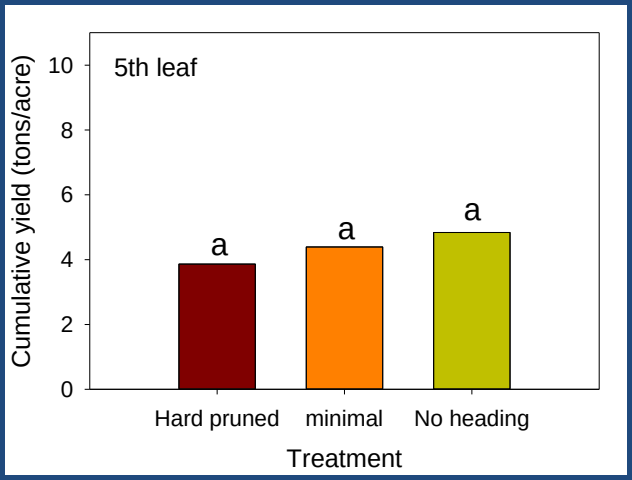
1/30/14

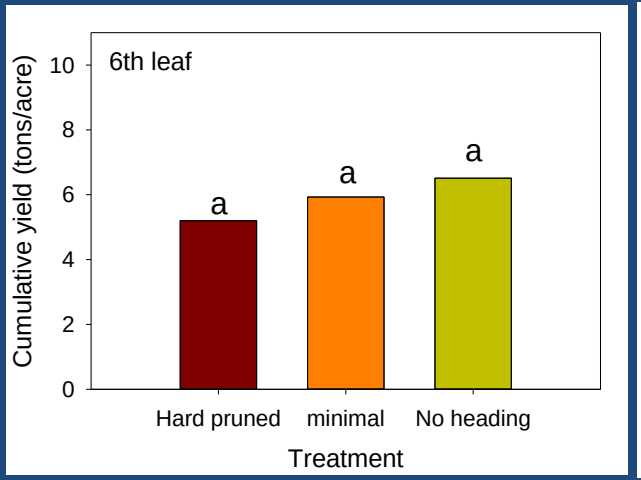
Minimal pruning

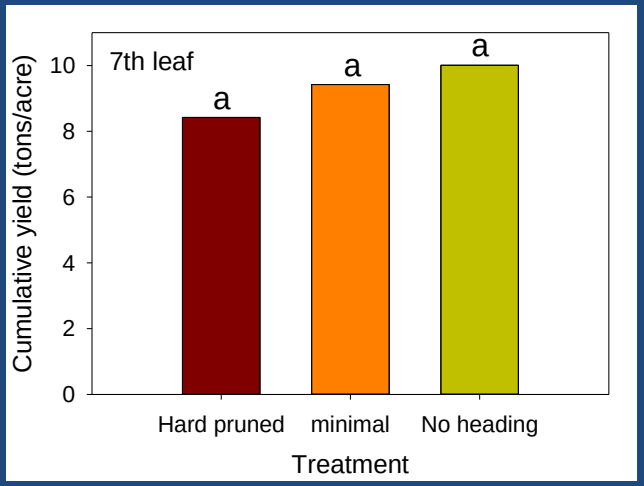
1/30/14

Unheaded/unpruned

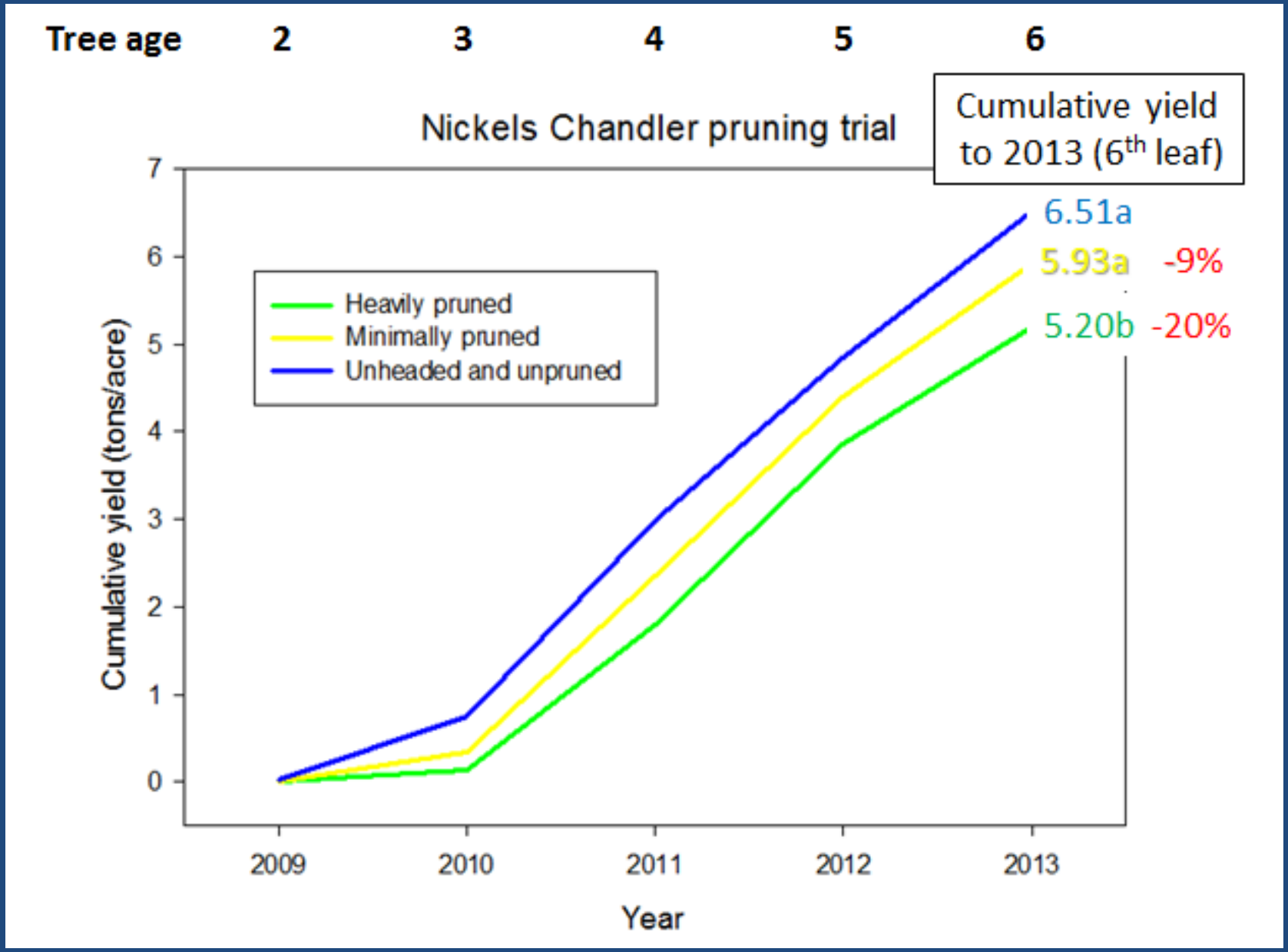
1/30/14



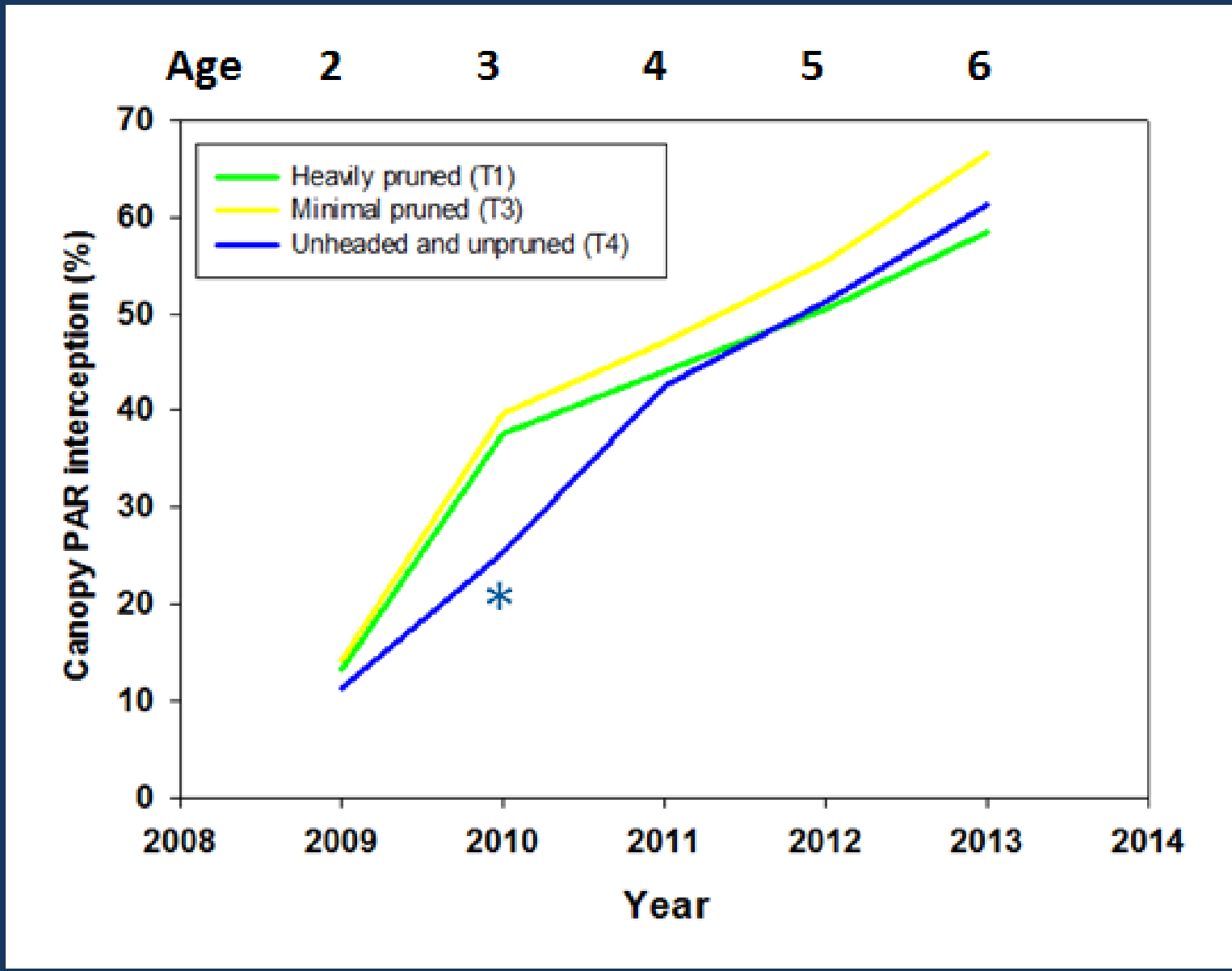


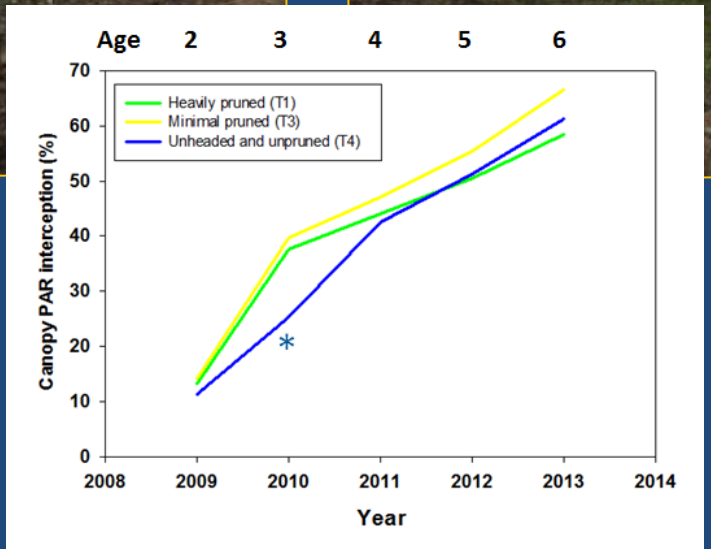


Cumulative yield by treatment and year for Chandler



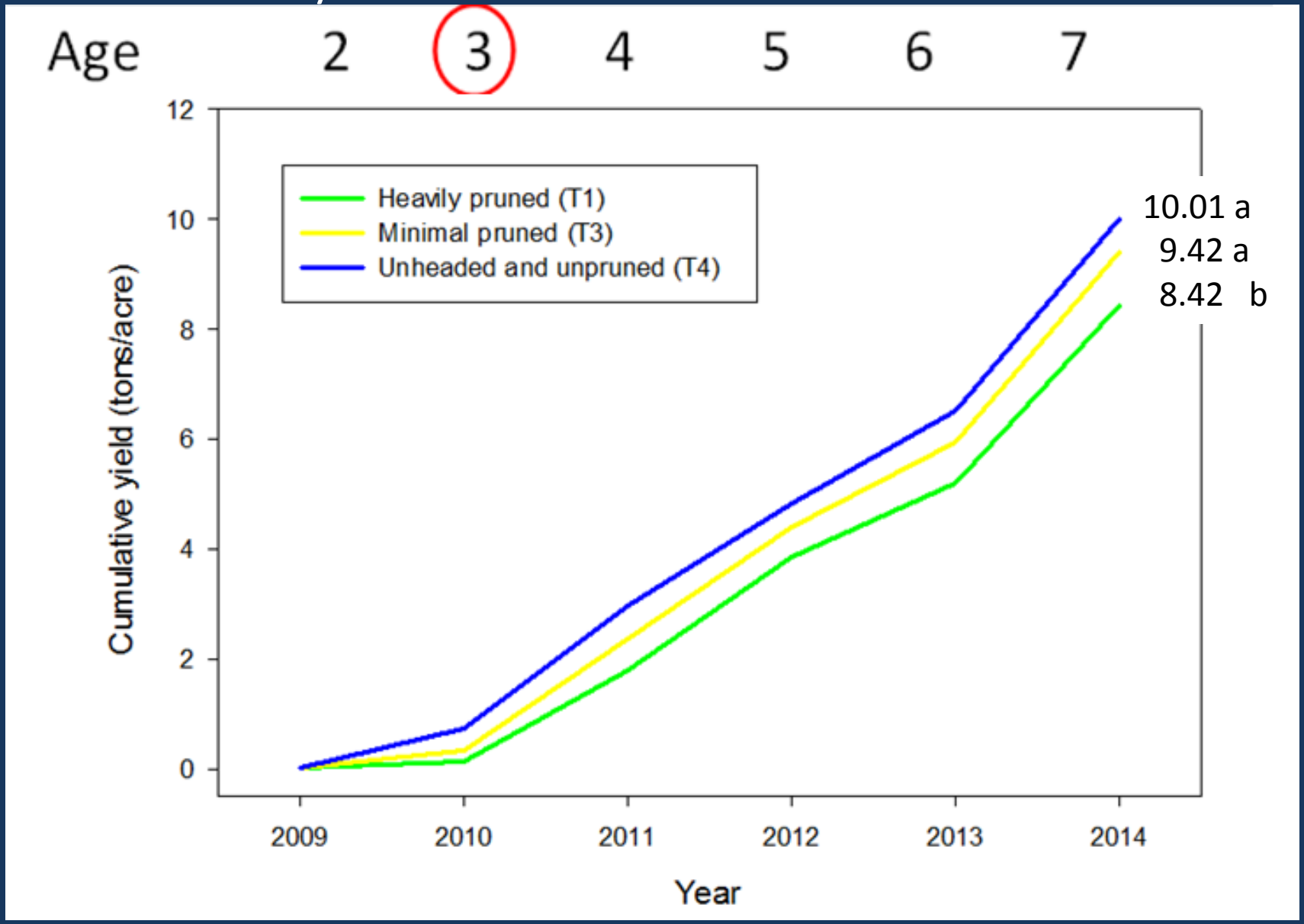
Midday canopy light interception by treatment and year for Chandler





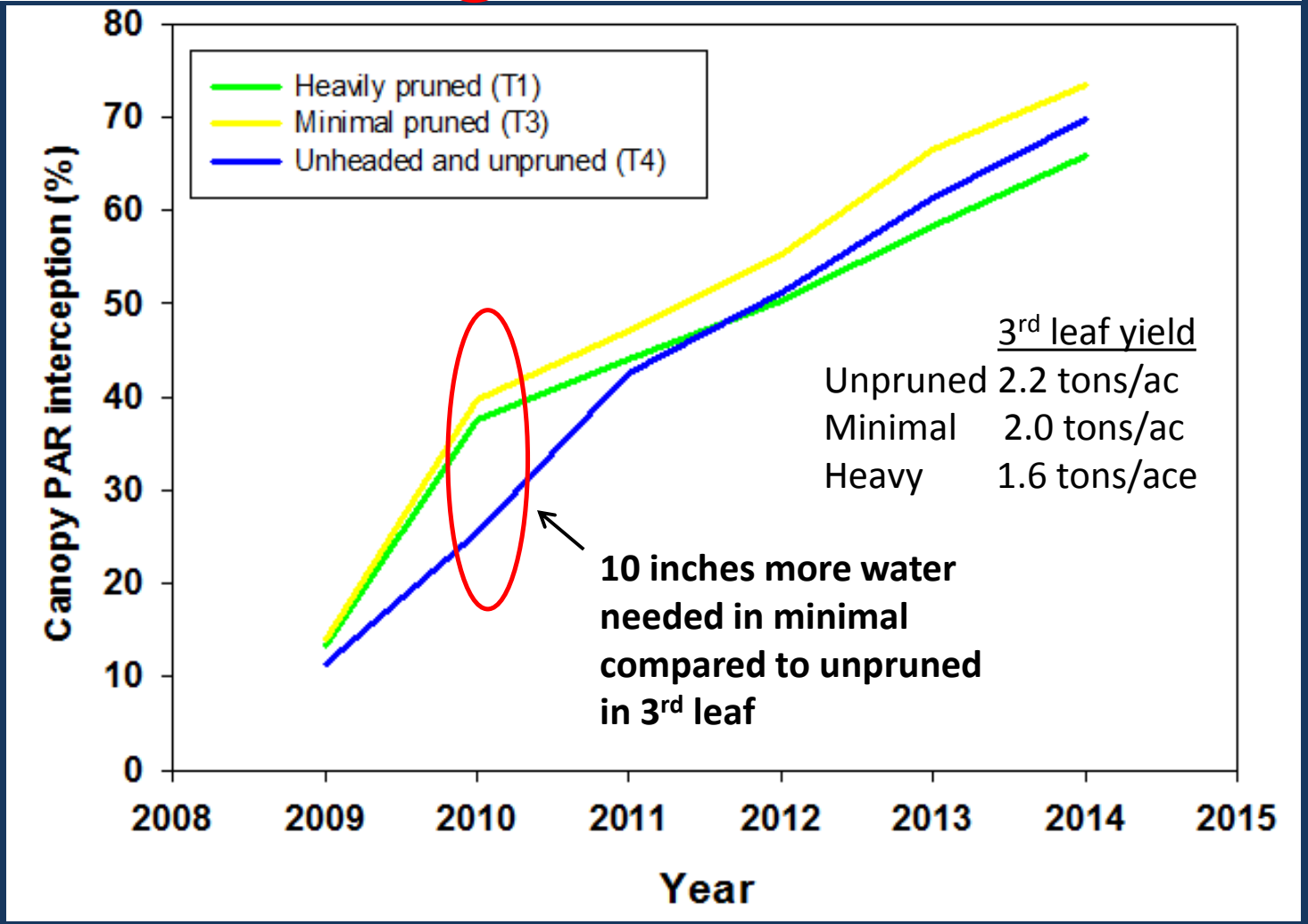
- Yield significantly higher
- Light interception significantly lower

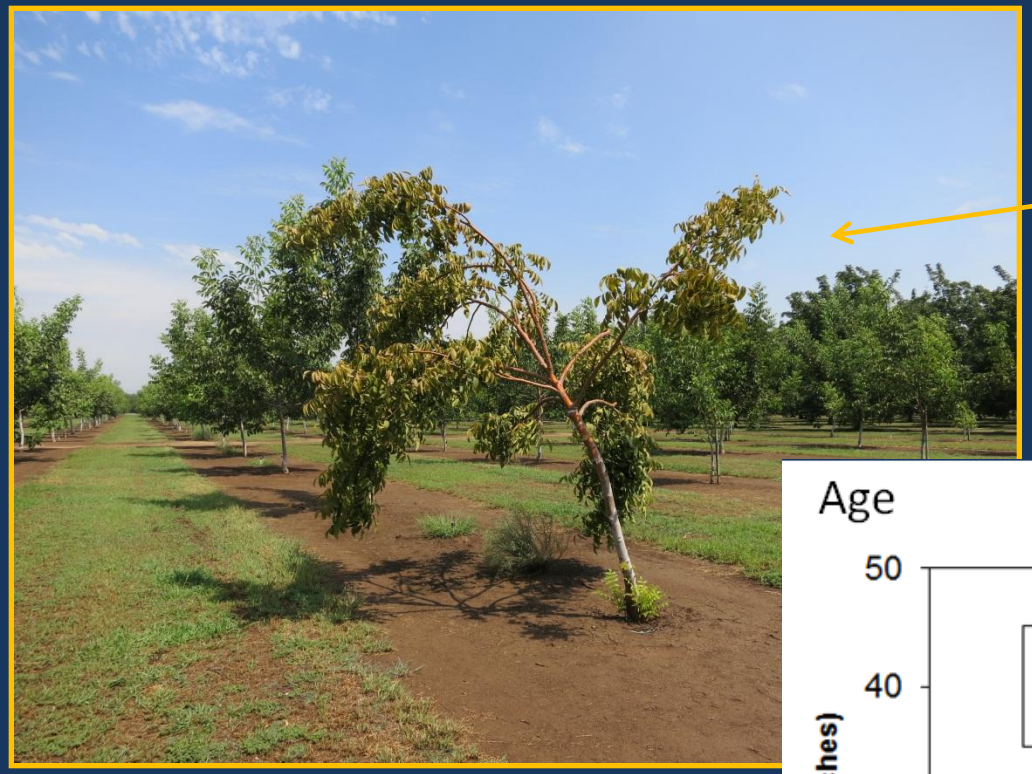
Higher midday canopy light interception combined with lower yield indicates lower water use efficiency for pruned treatments in years 2-6.



Water needed to support canopy based on proportion of 42 inches needed at 60% canopy cover

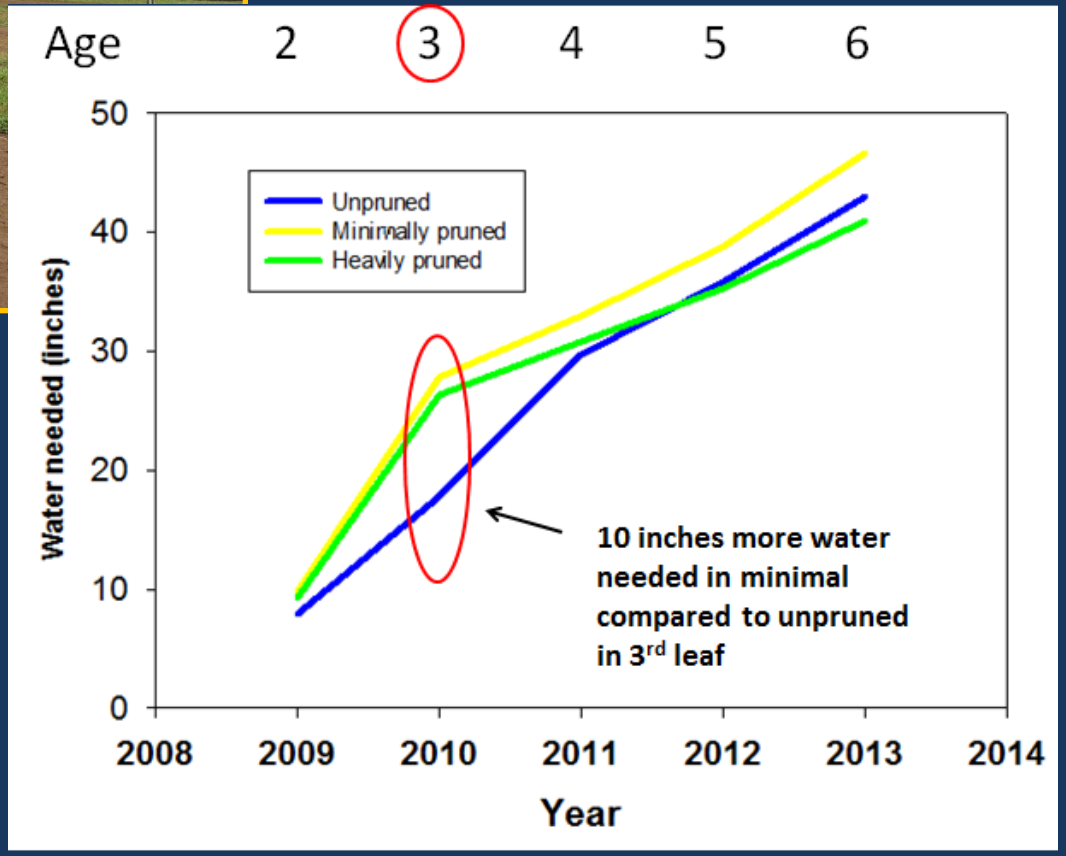
Age	2	3	4	5	6	7





A tree that looks like this has stalled out from overwatering, not from lack of pruning

Based on canopy size, 10 inches more water needed for minimally pruned in 3rd leaf



Water use efficiency for pruned versus unpruned treatments Years 2-6 summary

Treatment	Total water needed based on canopy size (years 2-6)	Cumulative yield (tons/acre)	Water use efficiency expressed as pounds of walnuts produced per inch of water applied	Water use efficiency (% of unpruned)
Unpruned	134	6.51	97	100
Minimally pruned	156	5.93	76	78
Heavily pruned	142	5.20	73	75

Chandler pruning trial summary

- Heavy pruning resulted in smaller trees and less yield in years 1-4
- After 6 years, cumulative yields are similar for unpruned and minimally pruned but significantly less for heavily pruned
- Water use efficiency higher in unpruned
- Pruning led towards tendency towards increased crown gall
- There were no benefits to either minimal or heavy pruning in this trial

The Howard and Chandler pruned versus unpruned trials do not support the common wisdom that you need to prune walnuts to get them to grow and be productive

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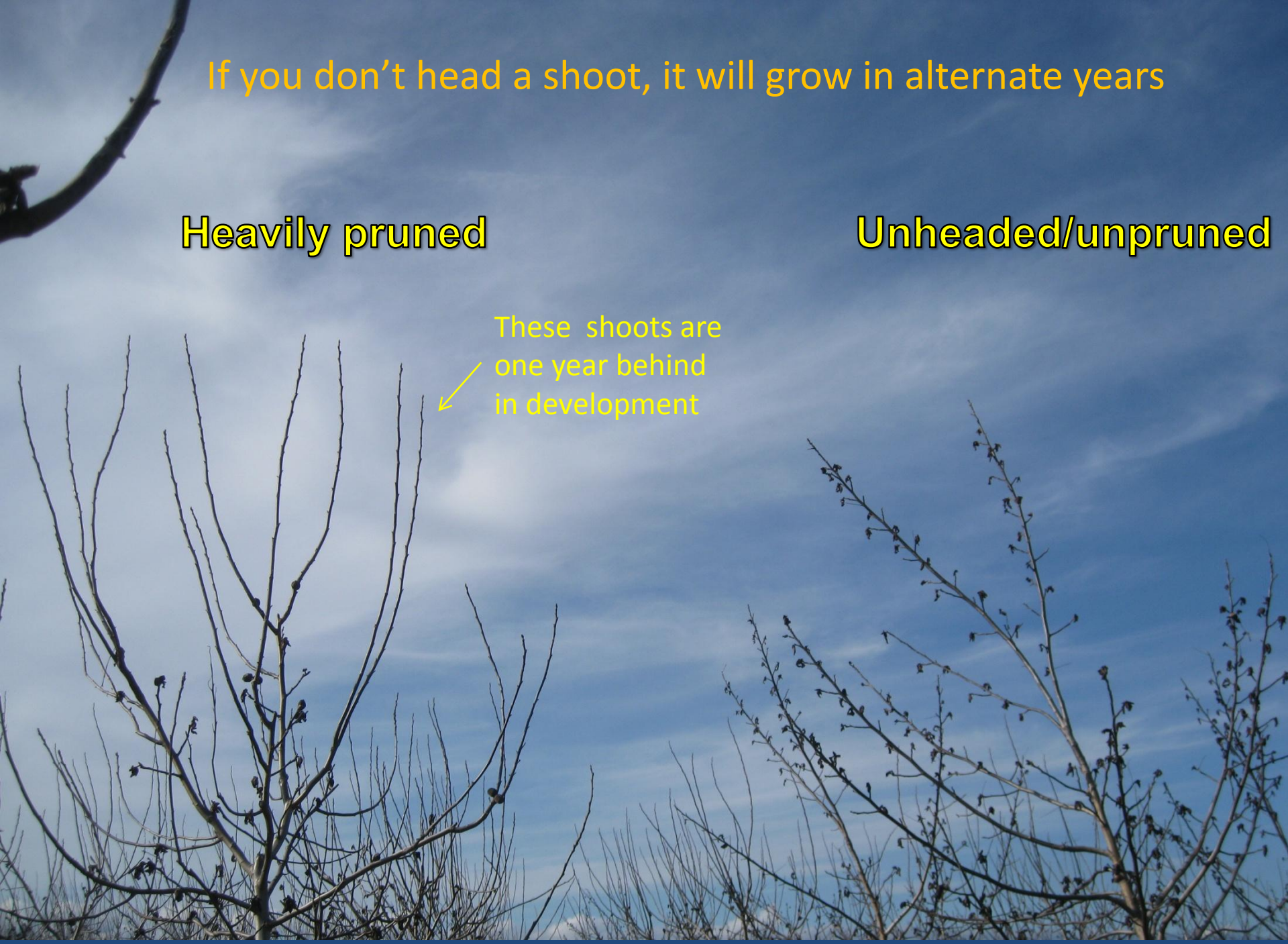

If you don't head a shoot, it will grow in alternate years
Heavily pruned
Unheaded/unpruned
These shoots are one year behind in development


Heavily pruned
Unheaded/unpruned

How to train and prune using different methods

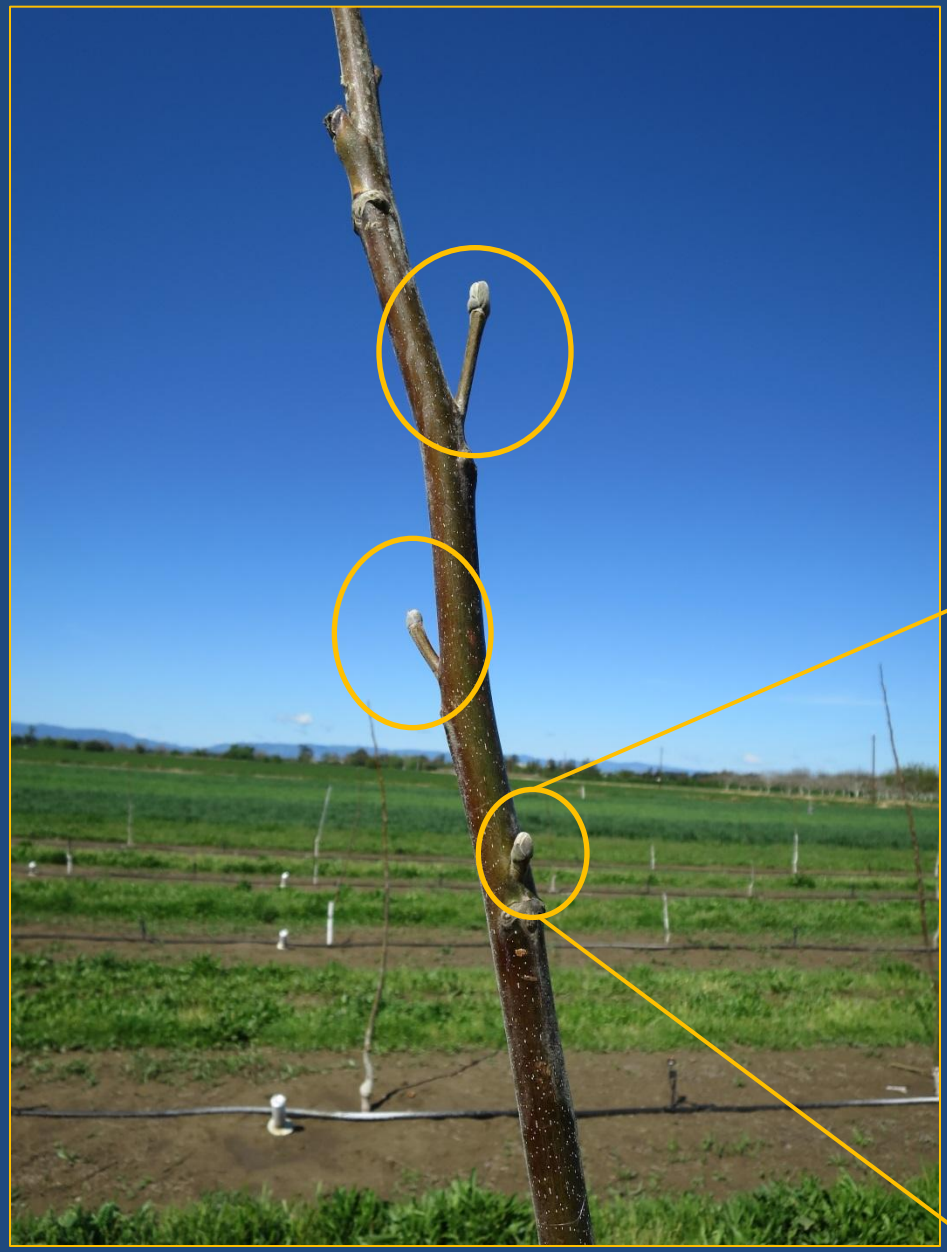
- Heavily pruned
- Minimally pruned
- Untrained/unpruned

Heavily pruned- don’t do this

Minimal pruning- winter following 1st leaf

Head to 6-8’

Grow leader to 10 feet plus the first season
Remove and in-season branching points

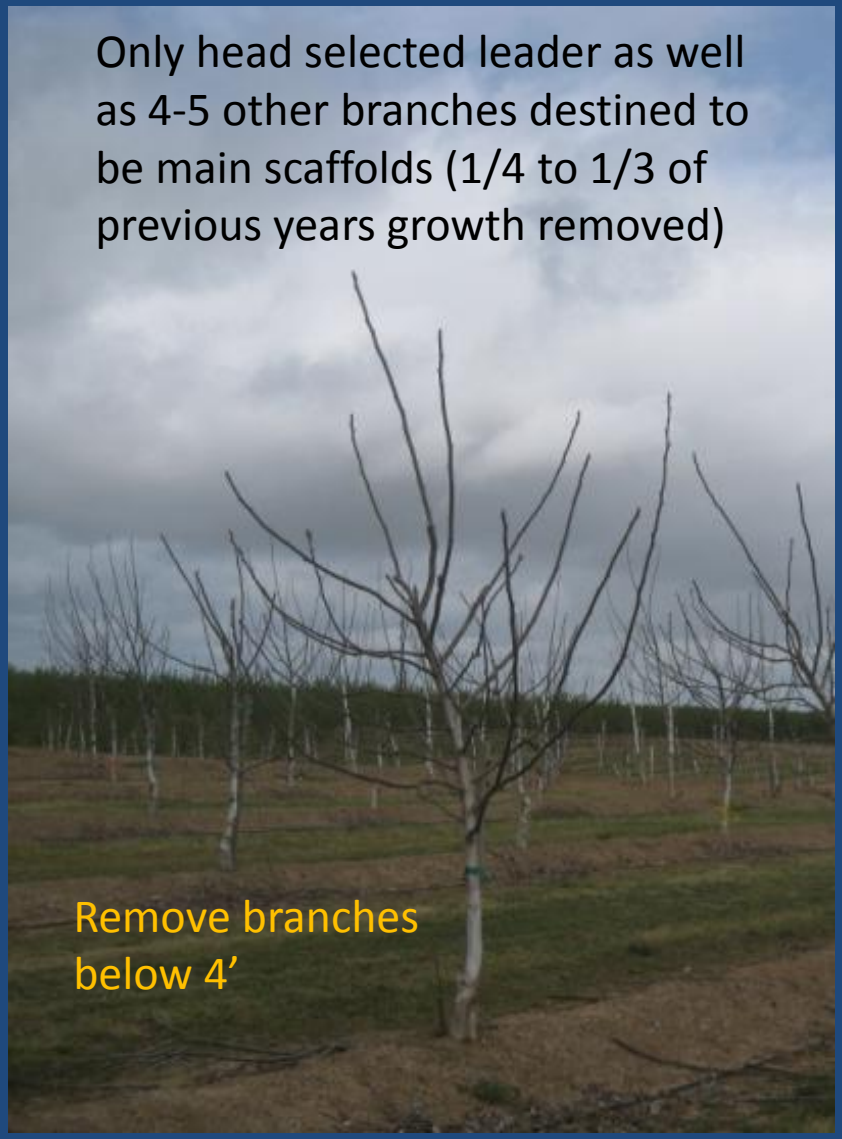


Necked buds should be removed

Necked bud left in main structure

Minimal pruning- winter following 2nd leaf

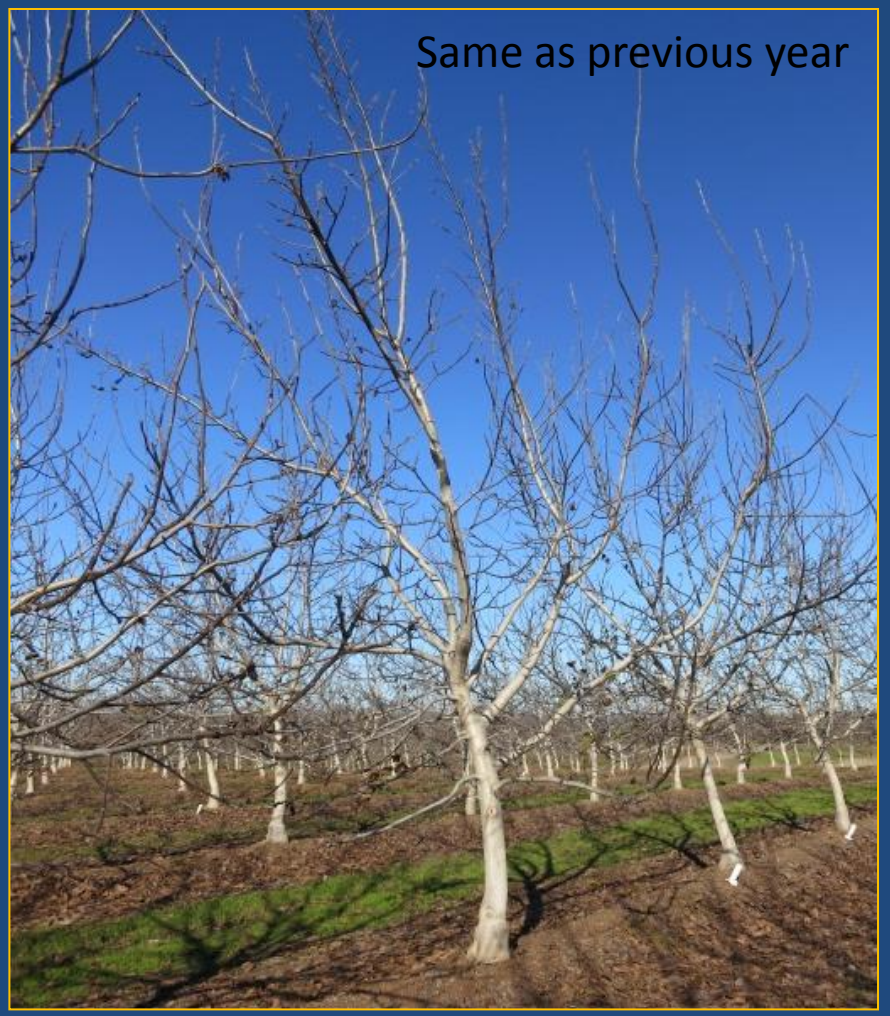
Before pruning



After pruning

Minimal pruning- winter following 3rd leaf

Before pruning



After pruning

Untrained/unpruned- winter following 1st leaf

Untrained/unpruned- winter following 2nd leaf

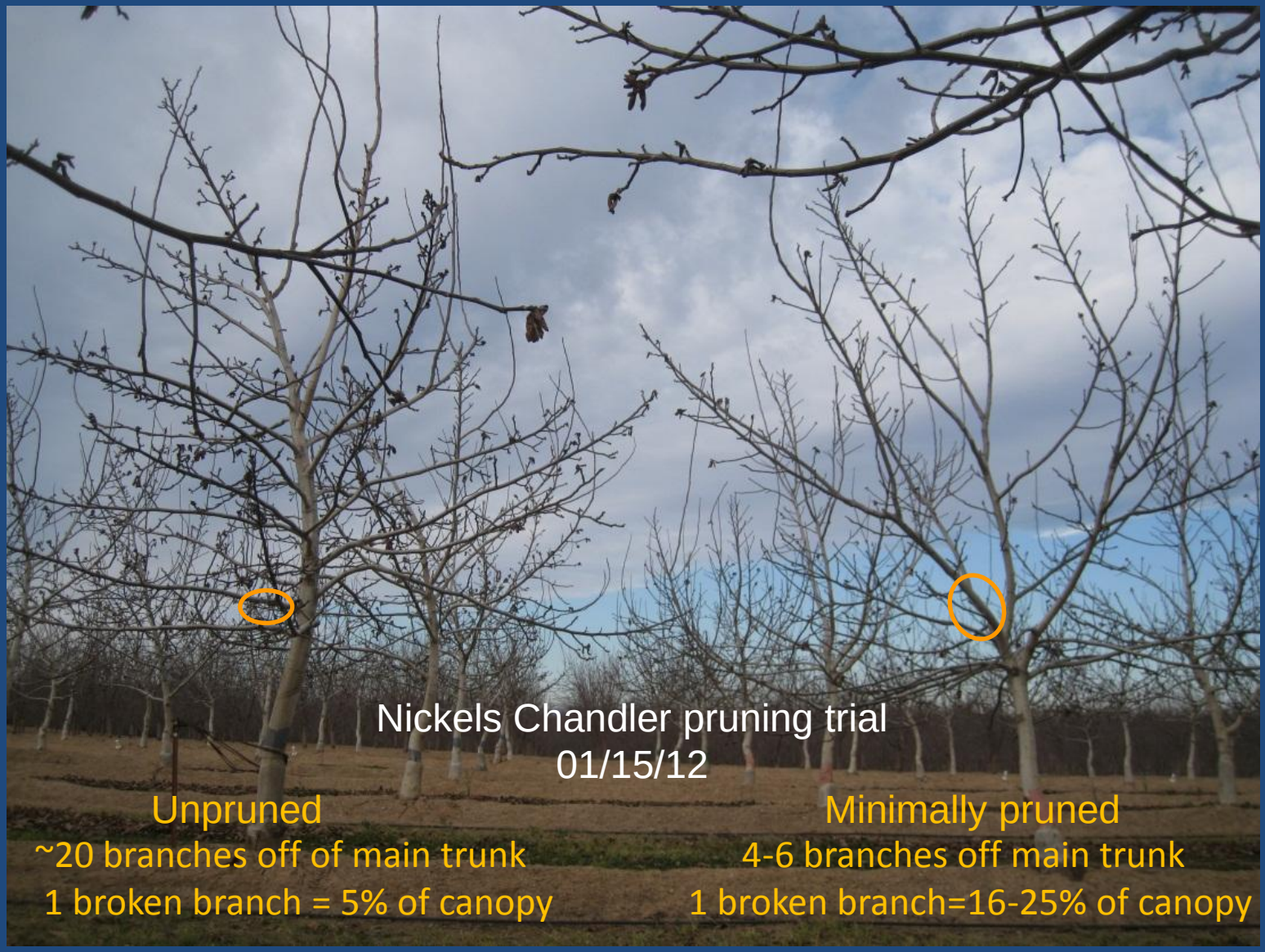
May want to remove in season branching points although we did not after first dormant period

Remove lower branches that will impede shaking- do not head them but rather remove entirely to main trunk

Untrained/unpruned- winter following 3nd leaf on

Watch them grow in summer and go skiing in winter

3rd 4th 5th 6th


Nickels Chandler pruning trial
01/15/12
Unpruned
~20 branches off of main trunk
1 broken branch = 5% of canopy
Minimally pruned
4-6 branches off main trunk
1 broken branch=16-25% of canopy

We rarely see broken branches in unpruned trees but if we do it is usually in the 3rd or 4th leaf when they are still quite small (and a small part of canopy)

- No broken branches in unpruned treatment in Nickels Chandler trial and most in minimally pruned treatment

In pruned trees breakage tends to occur 3 or so years after pruning stops (usually 5-7 leaf) and a large part of canopy is lost (maybe 15-20%)

Breakage 3 years after pruning stopped in Chandler orchard in Lake County


More open structure
Longer light path
Shorter light path
Shading related dieback will occur earlier
Flatter branch angles
December 2012
Heavily pruned
Unheaded/unpruned

Quality problems in center of tree tend to be less severe with central leader tree structure- shorter light path through tree

In our pruned versus unpruned trials in walnut, after a total of 13 years of data collection (7 years on Howards and 6 years on Chandlers), we have yet to find an advantage to any pruning cut except those made to provide orchard access or remove in season branching points in 1st or maybe 2nd leaf

Pruning related problems (besides money spent to prune and dispose of prunings)

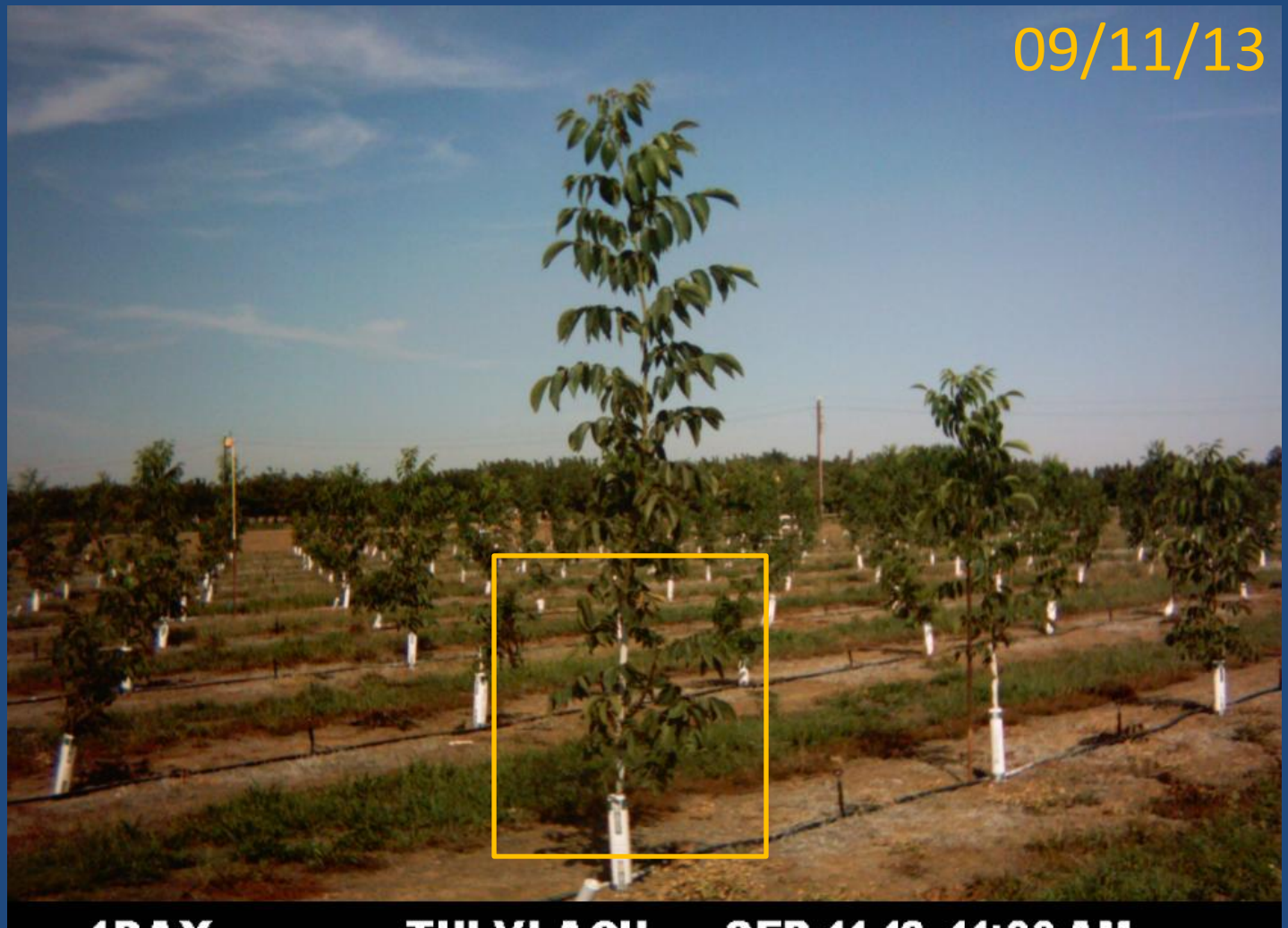
- Slightly lower quality/size for pruned in some cases
- More scaffold breakage in years after pruning stops
- More rapid shading of lower canopy- this is related to quality problems
- Lower water use efficiency
- Potentially more crown gall with pruning

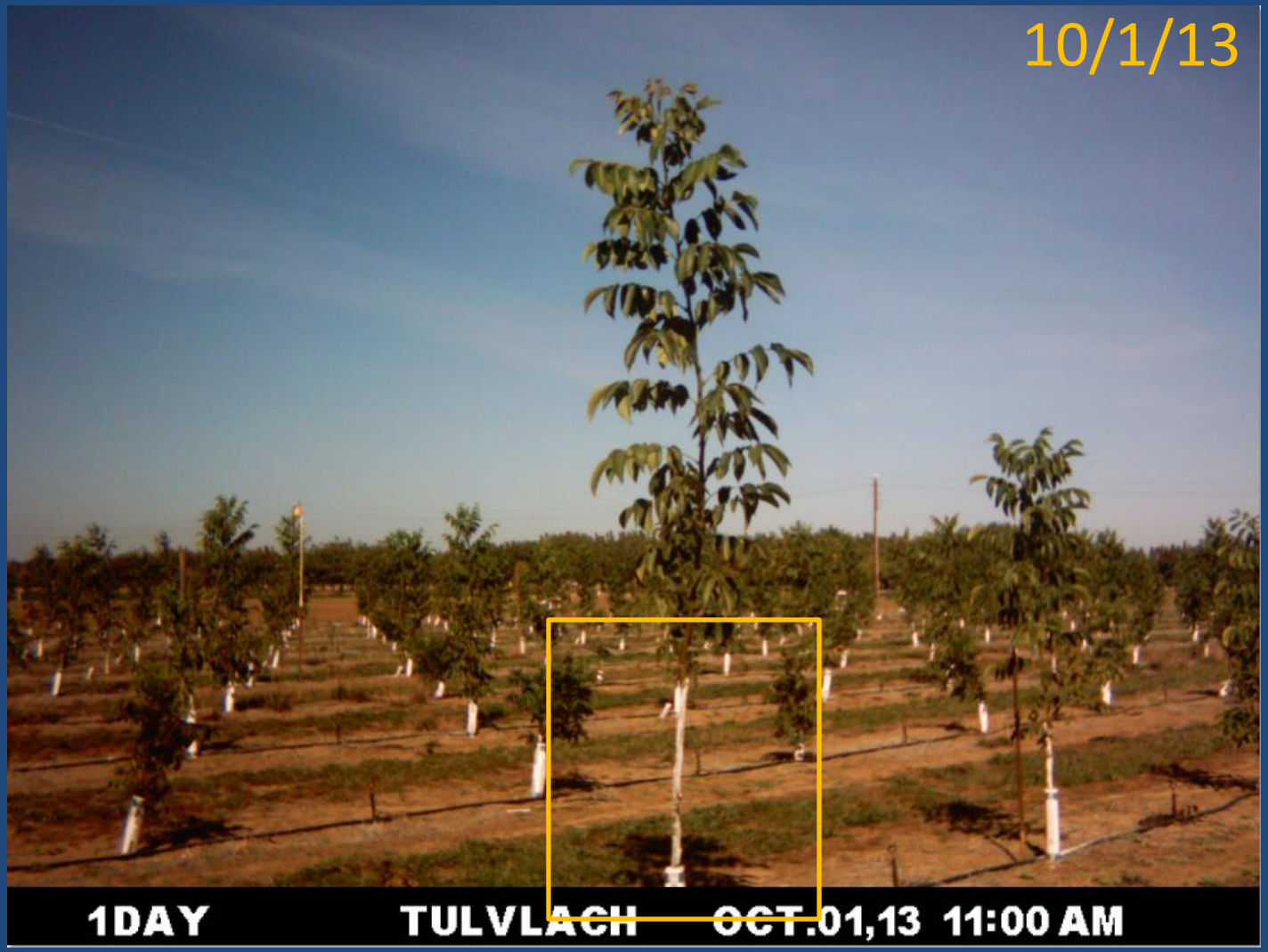

04/10/13

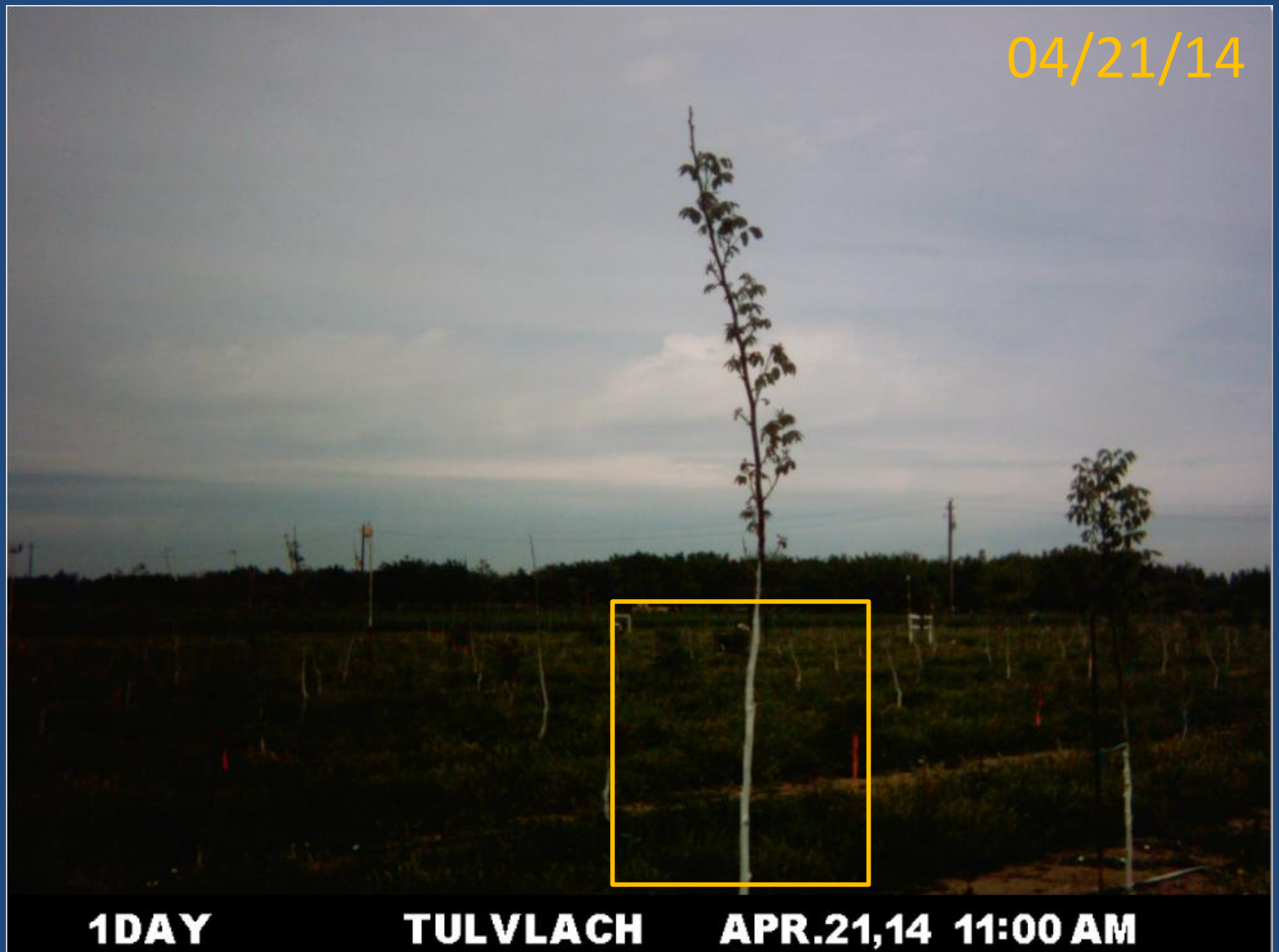

06/10/13


07/10/13


08/10/13


09/11/13


10/1/13
1DAY
TULVLACH
OCT.01,13 11:00 AM


04/21/14
1DAY
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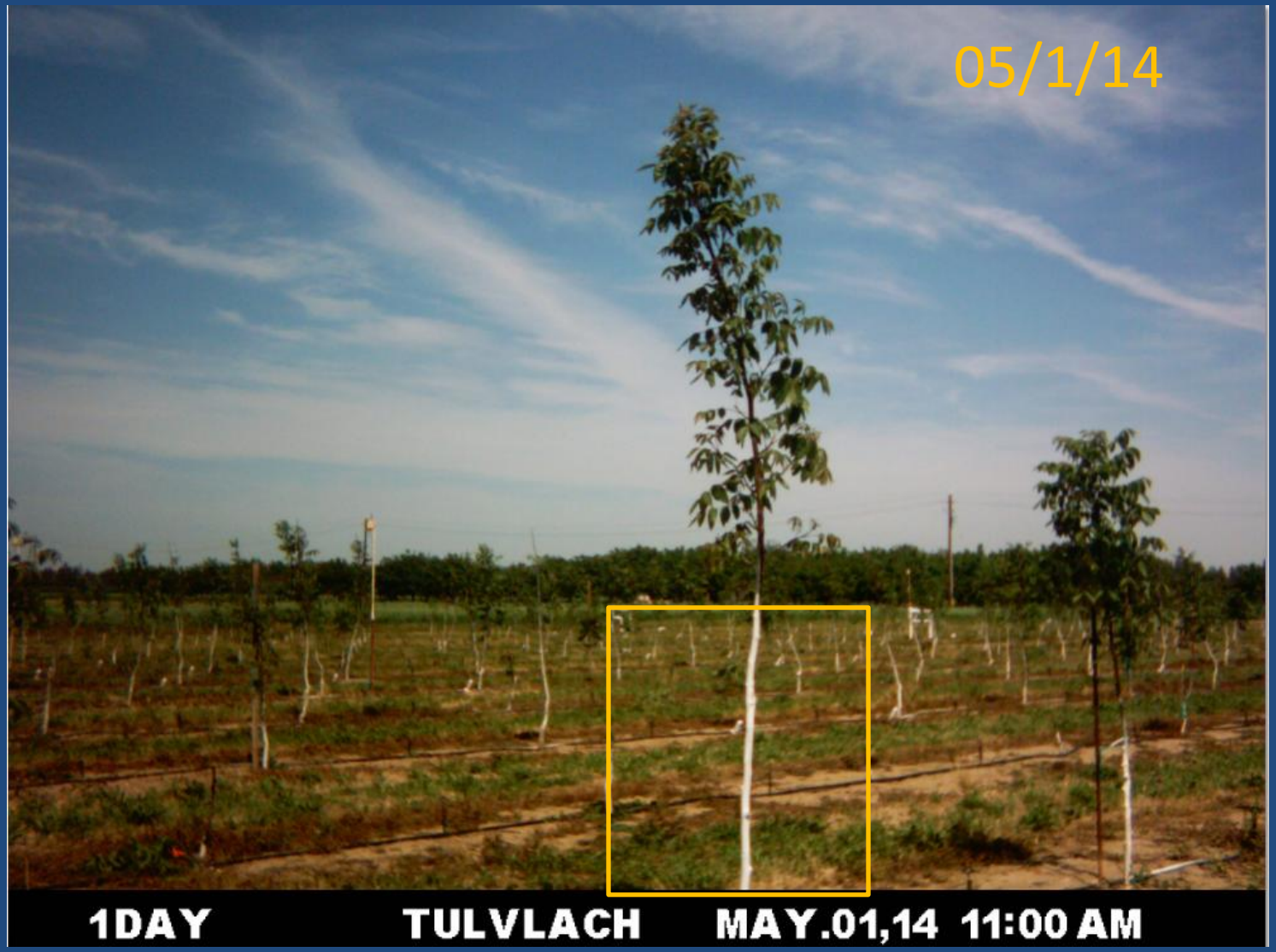
APR.21,14 11:00 AM


05/1/14
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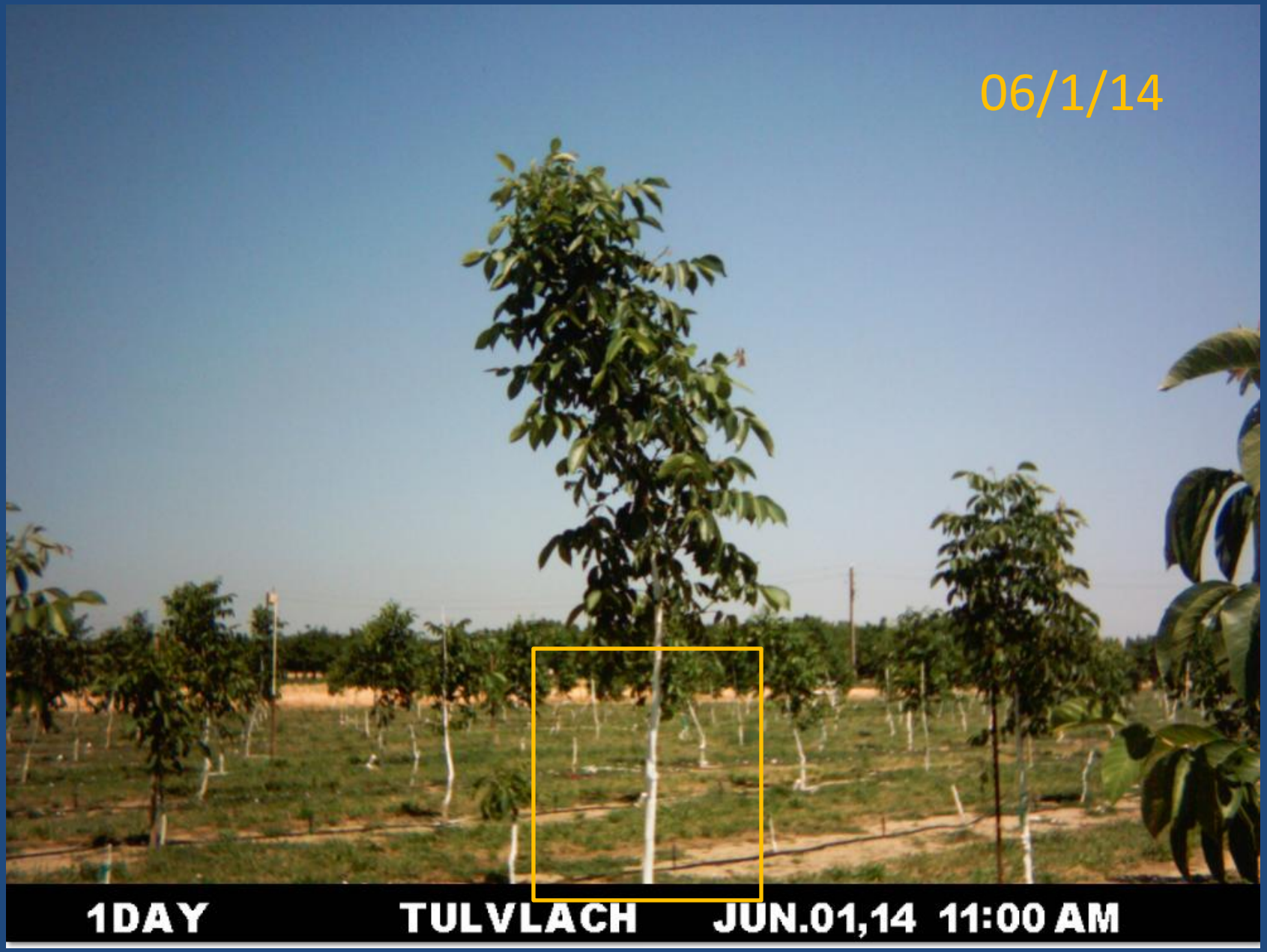
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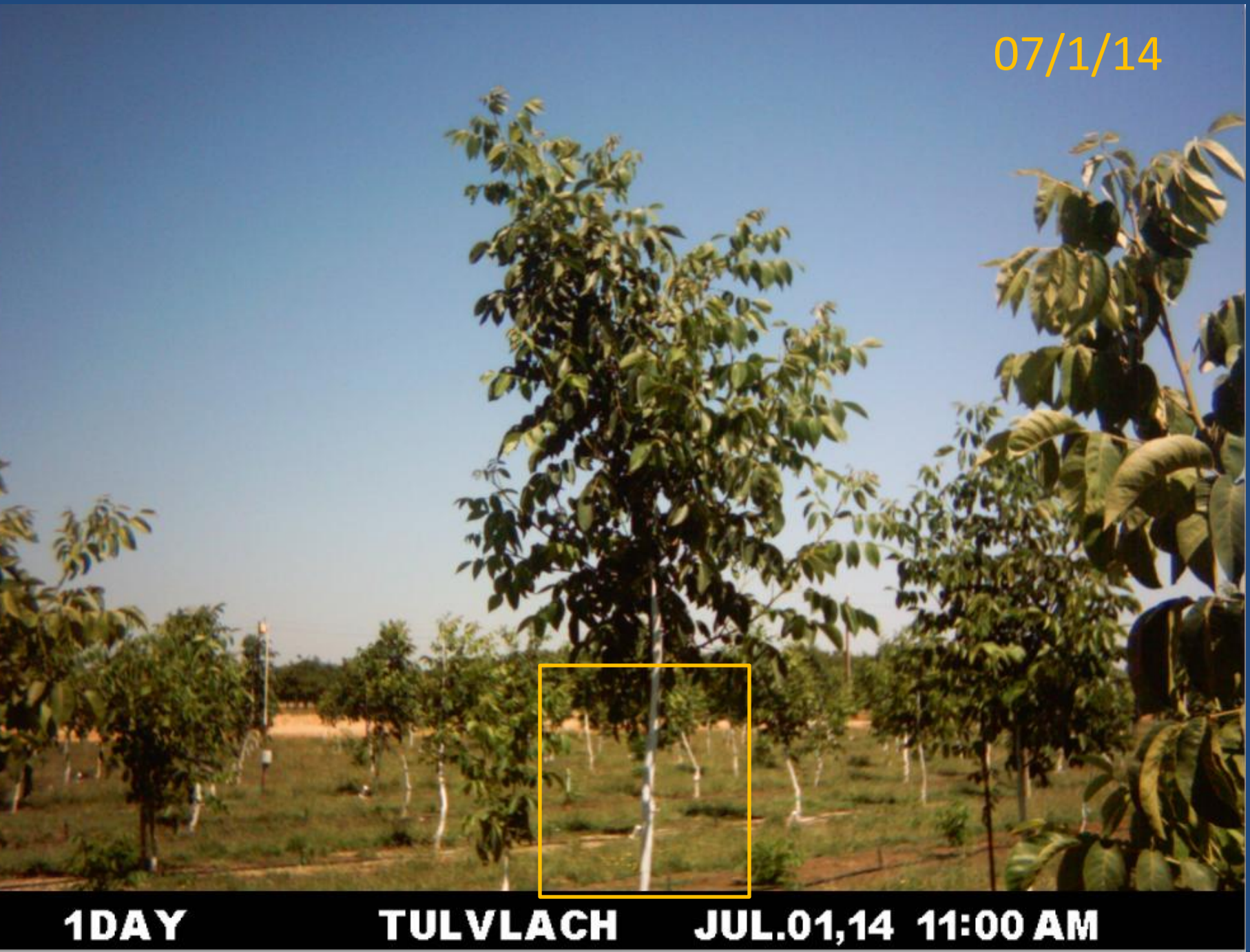
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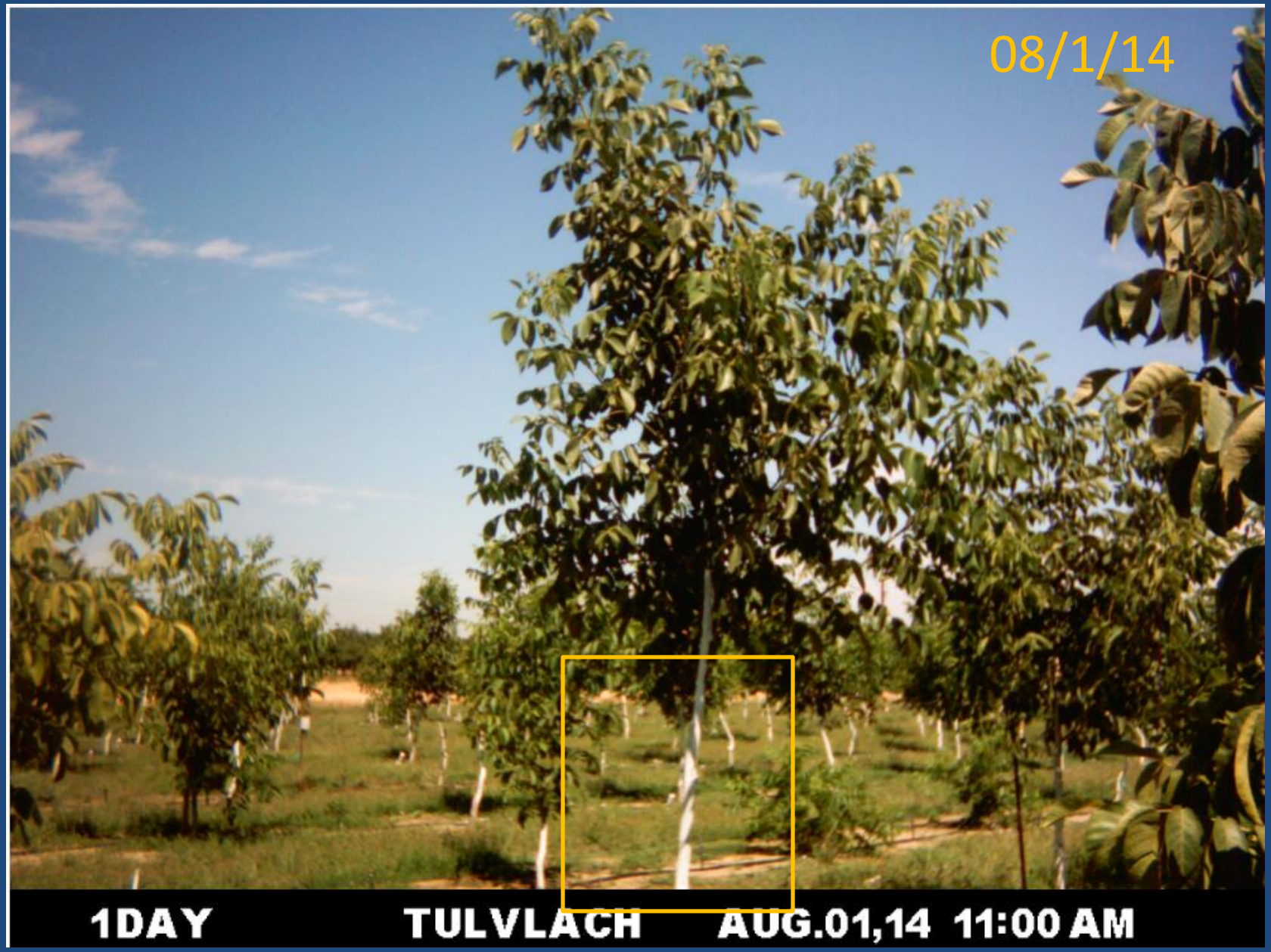
08/1/14
1DAY
TULVLACH
AUG.01,14 11:00 AM


09/1/14
1DAY
TULVLACH
SEP.01,14 11:00 AM


10/1/14
1DAY
TULVLACH
OCT.01,14 11:00 AM


1/3/15
TULVLACH JAN.03,15 11:00 AM

Nickels Chandler Pruning Trial Field Day

Heavy pruning

1/30/14

Minimal pruning

1/30/14

Unheaded/unpruned

1/30/14

Field day will be held at this site on March 3rd, 2014 at 9:30 am
(March 5th at 9:30am if it rains on March 3rd)
Location- Nickels Soil Lab, Green Bay Avenue, Arbuckle, CA

Another field meeting will be held at 2:30 the same afternoon near Wheatland to look at a grower trial with pruned and unpruned walnuts- UCCE Yuba/Sutter Counties for information or contact Janine Hasey (jkhasey@ucanr.edu)


Questions?