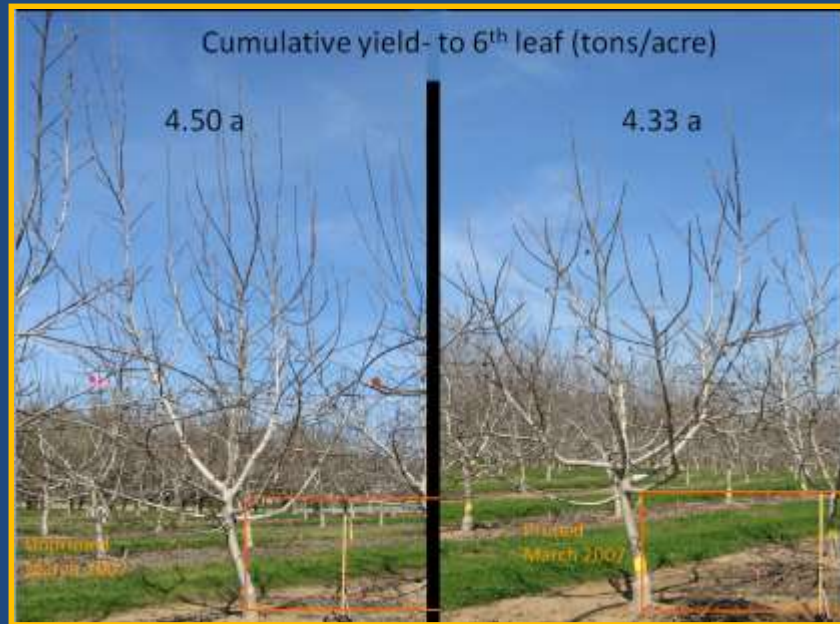


Pruning and Training Young Walnuts

Bruce Lampinen
UC Davis Plant Sciences



3rd

4th

5th

6th

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

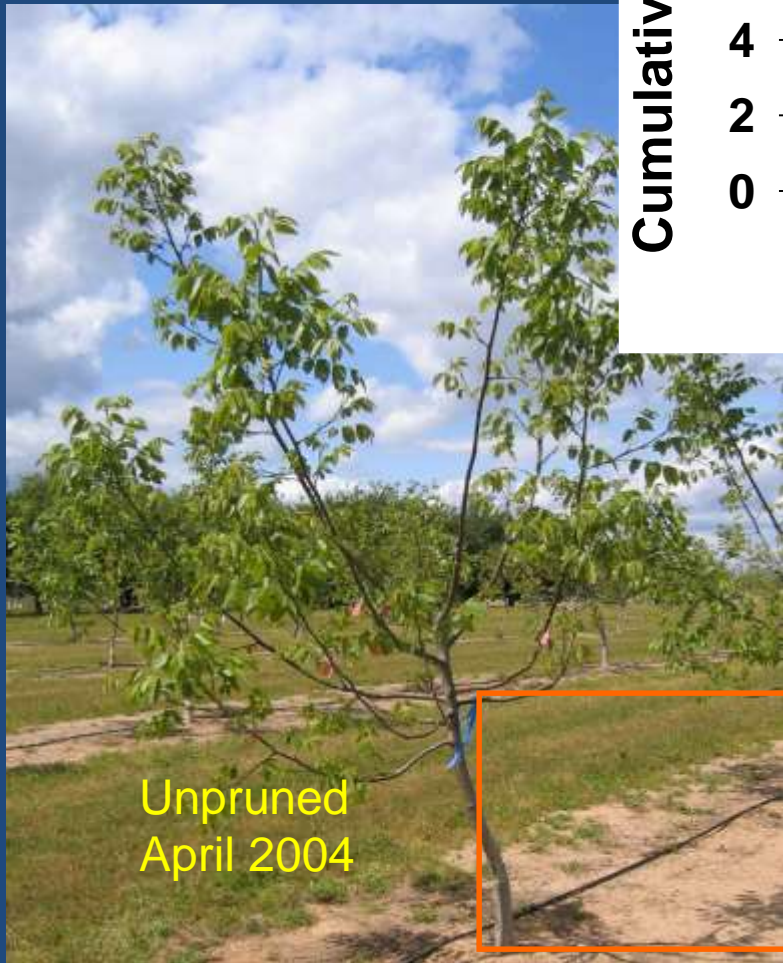
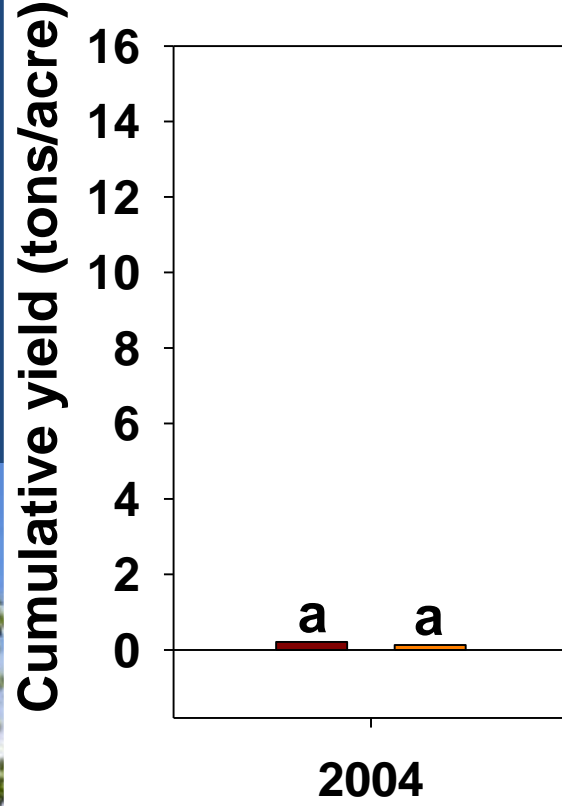
12' x 25' spacing (145 trees/acre)

Unpruned after scaffold selection

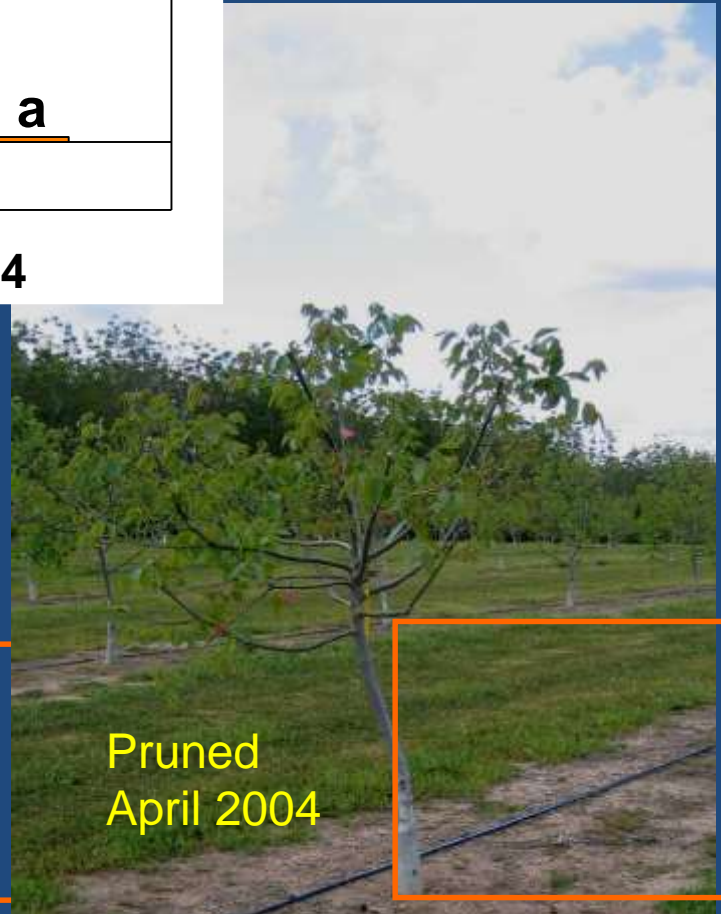
Pruned (1/3 of previous year growth
each year until tree fills
allotted space)



April 2004

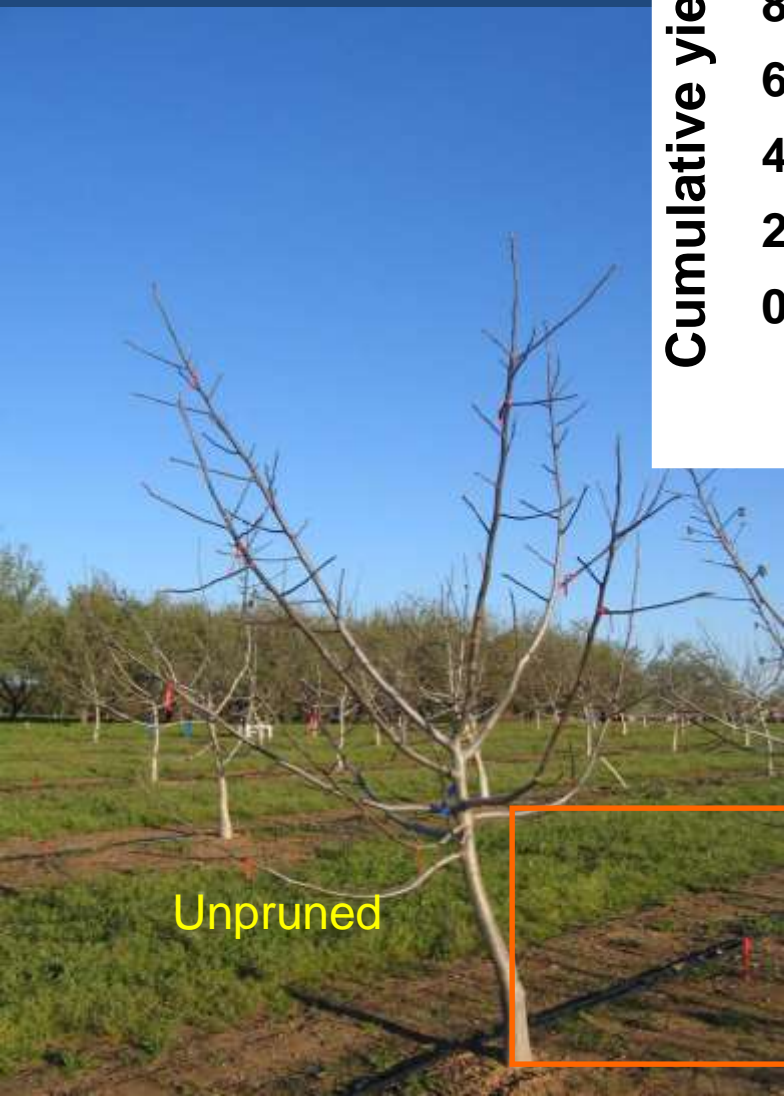
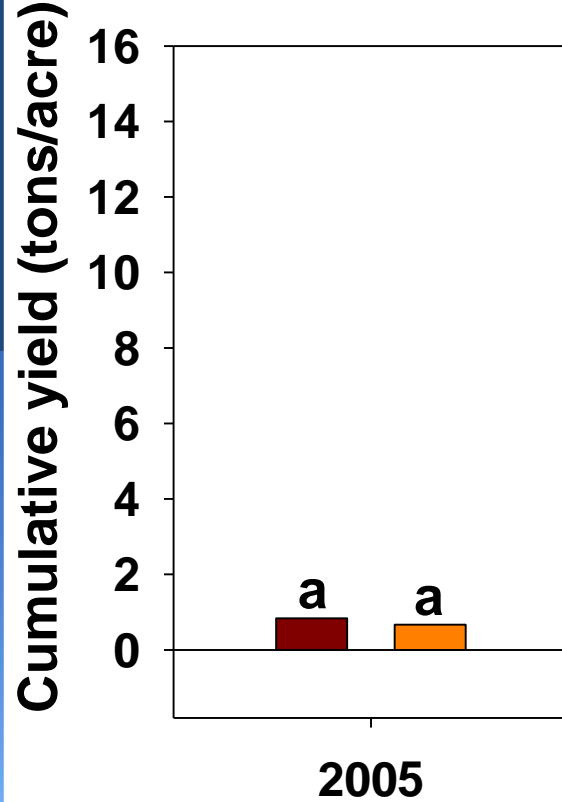


Unpruned
April 2004

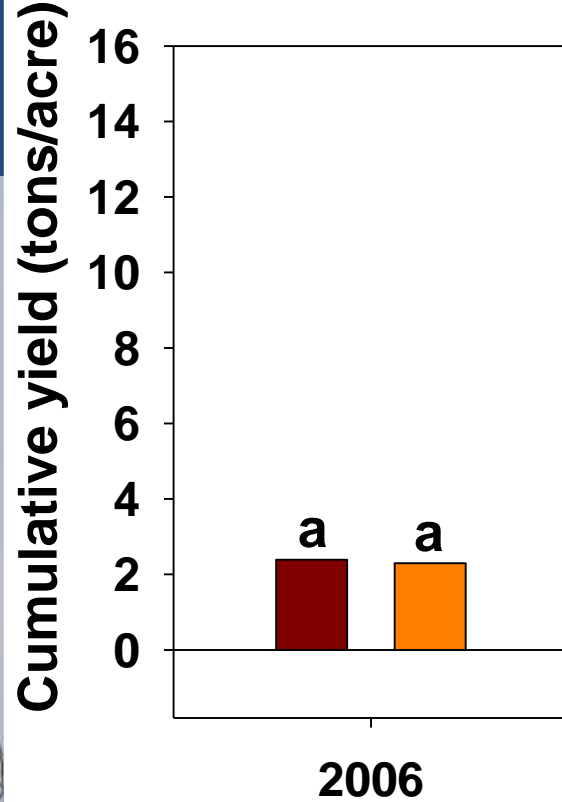


Pruned
April 2004

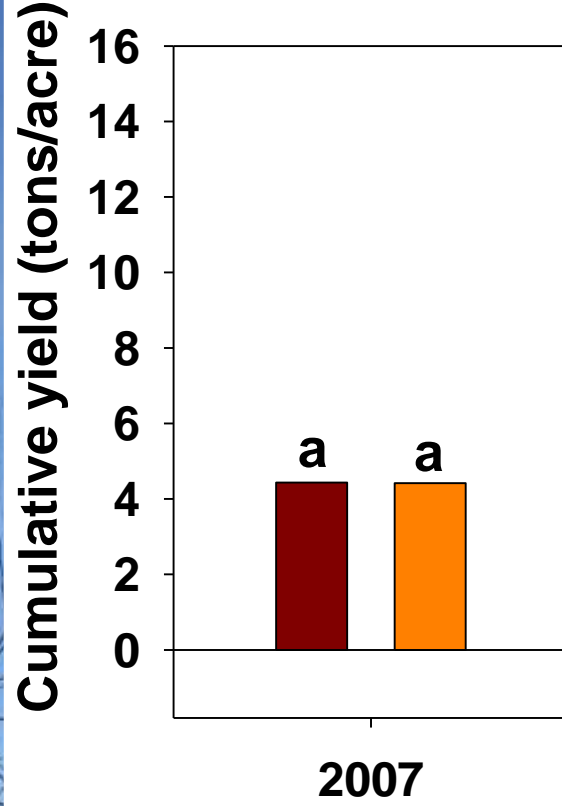
March 2005



March 2006

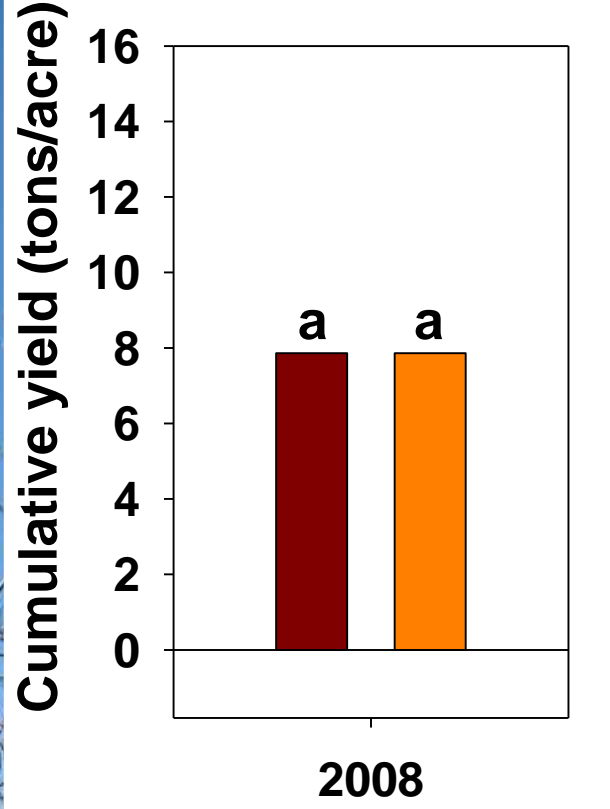
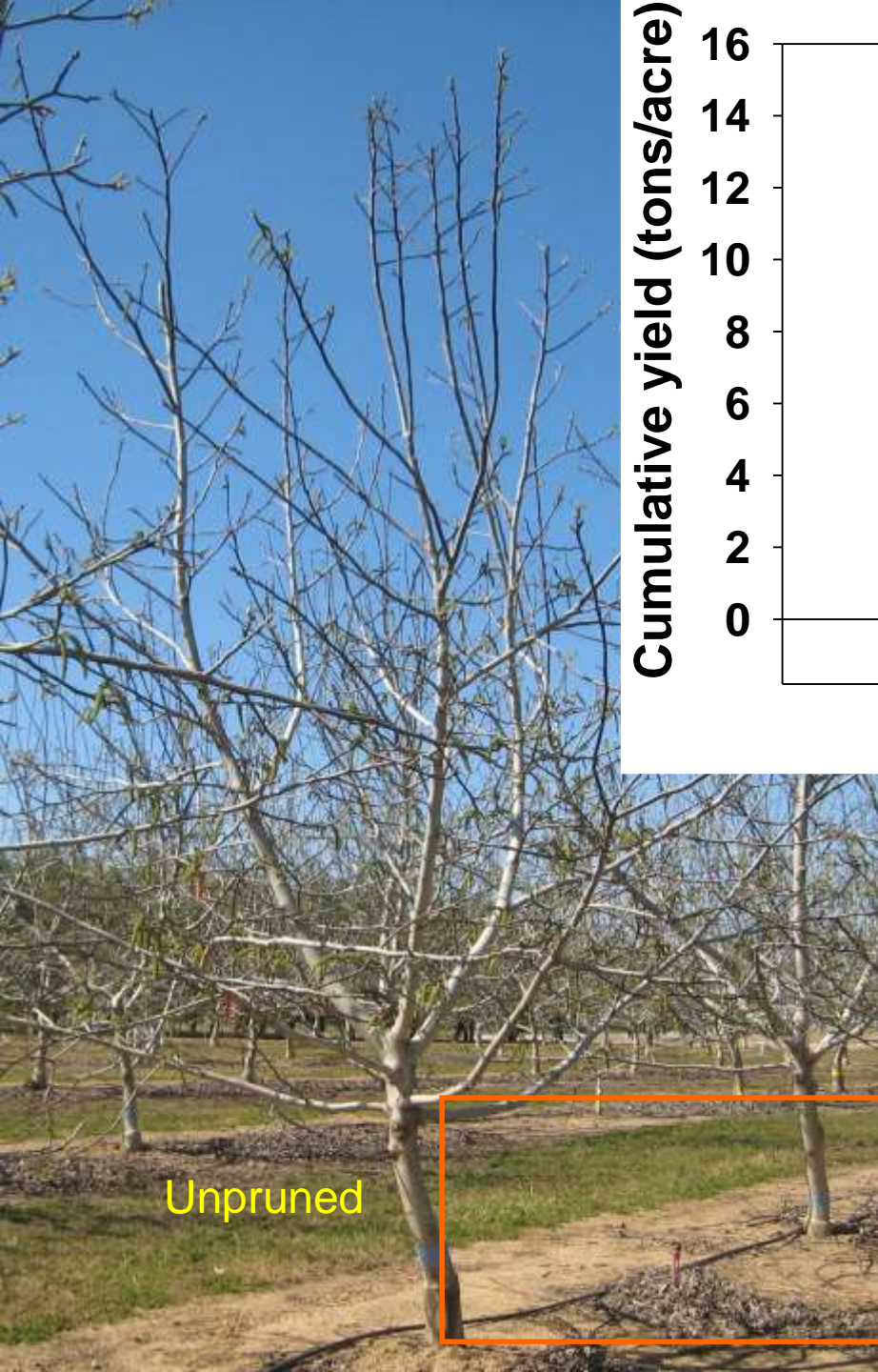


March 2007



Unpruned

Pruned

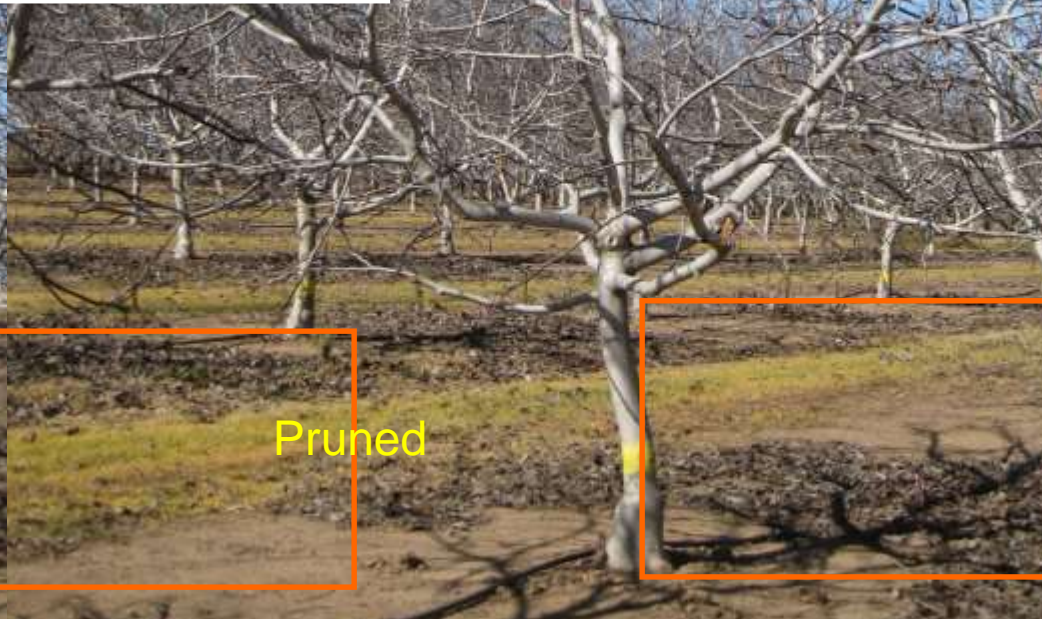
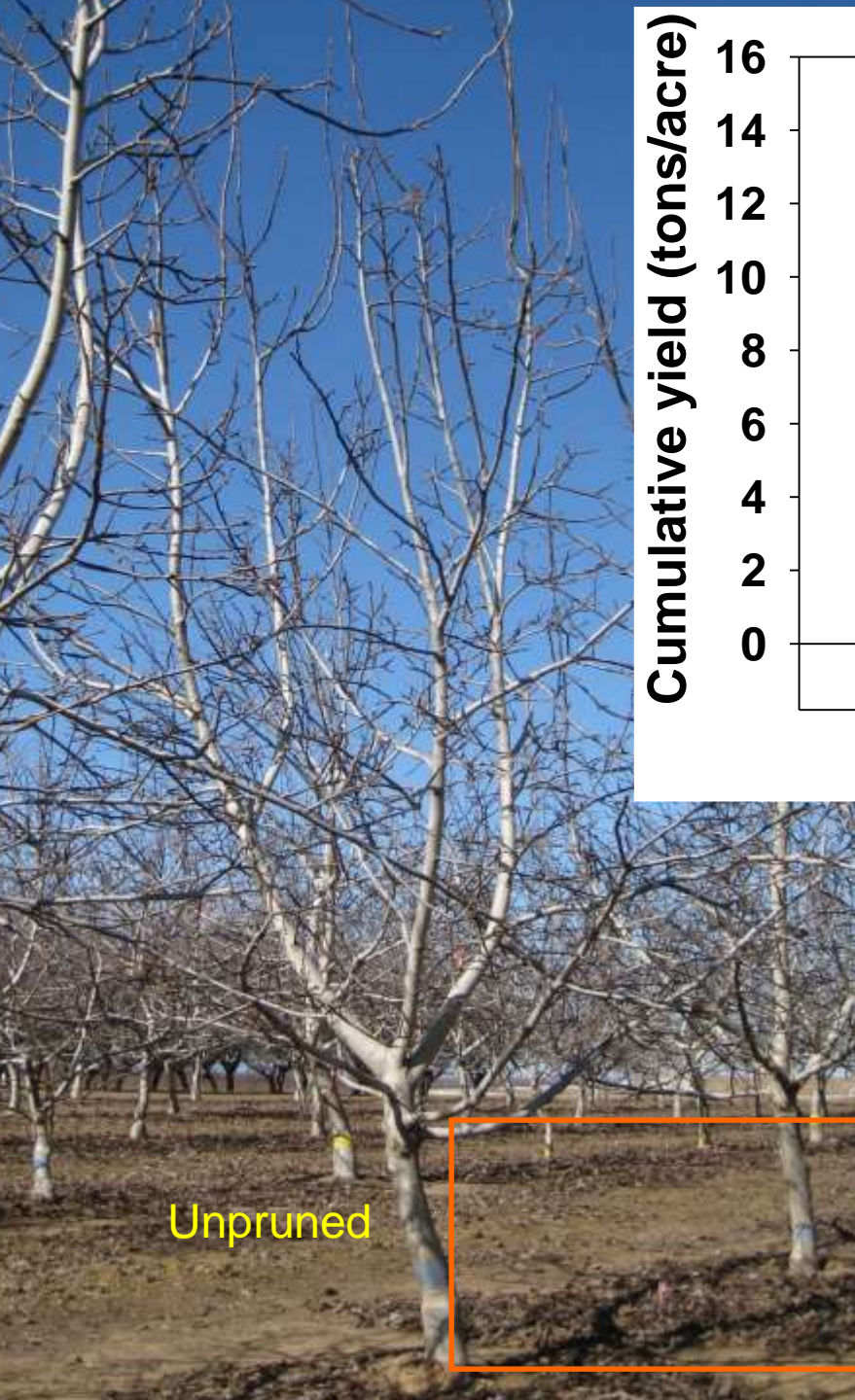
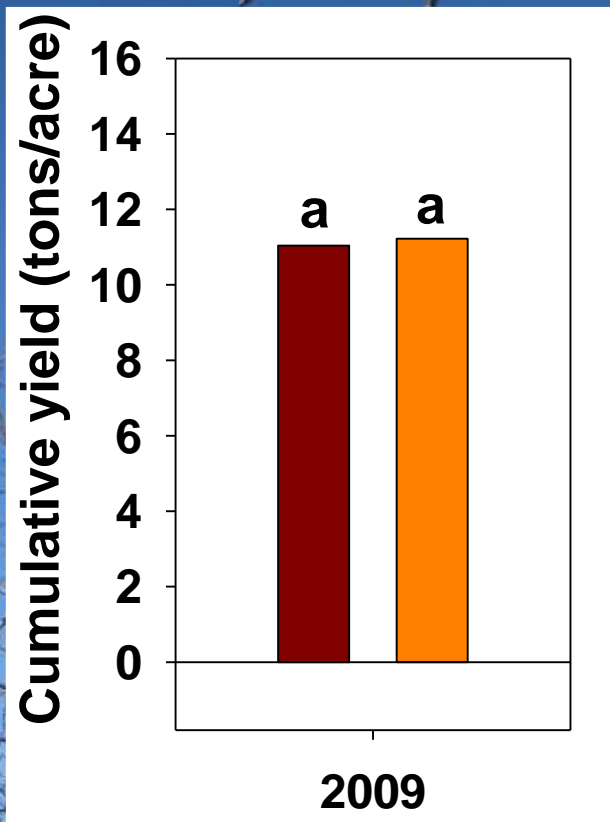


March 2008

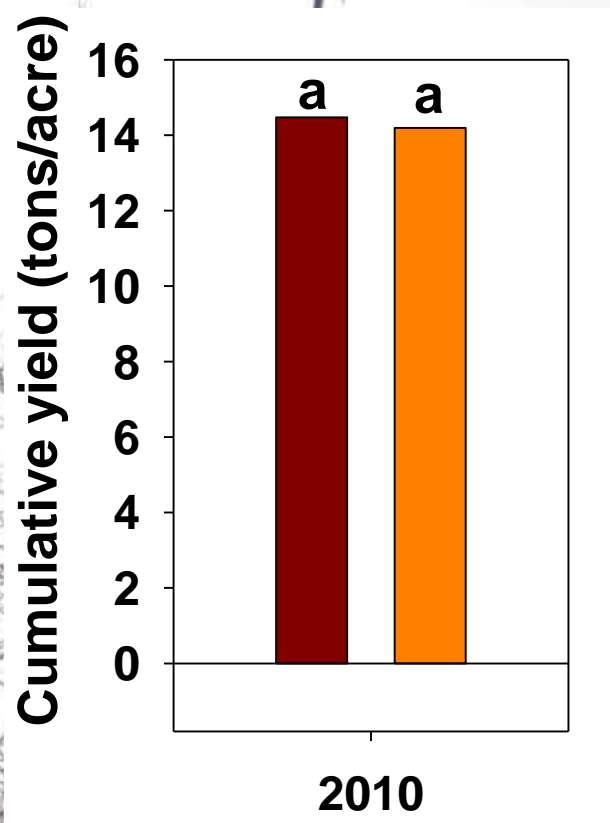
Unpruned

Pruned

February 2009



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

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

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

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

Heavy pruning



Minimal pruning



Unheaded/unpruned



After first growing season

Before pruning

Heavy pruning



Minimal pruning



Unheaded/unpruned



After pruning

Heavy pruning



Minimal pruning

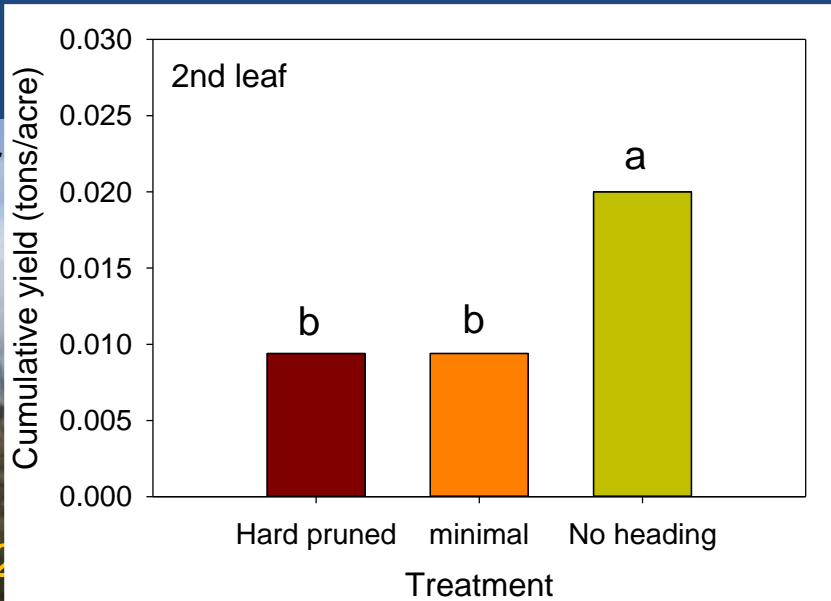
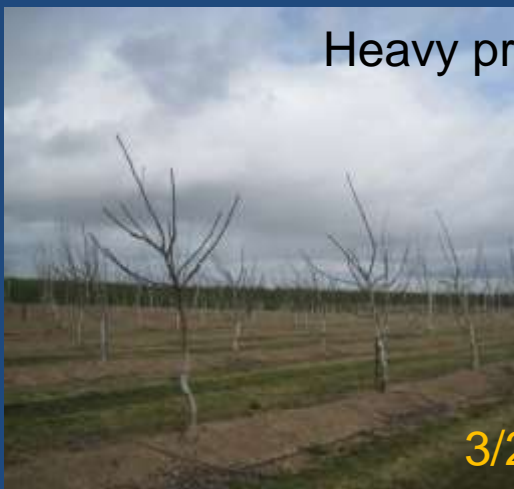


Unheaded/unpruned



After second growing season

Before pruning



After second growing season

Before pruning

Heavy pruning



Minimal pruning



Unheaded/unpruned



After pruning

Heavy pruning



Minimal pruning



Unheaded/unpruned



After third growing season

Before pruning

Heavy pruning



Minimal pruning



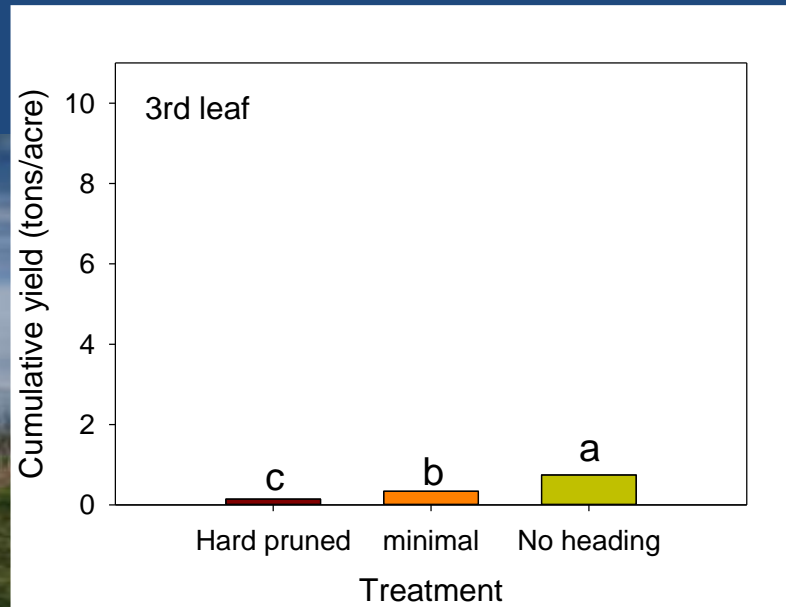
Unheaded/unpruned



Heavy pruning



Unheaded/unpruned



After third growing season

Before pruning

Heavy pruning

Minimal pruning

Unheaded/unpruned

1/15/12

1/15/12

1/15/12

Before pruning

Heavy pruning

Minimal pruning

Unheaded/unpruned

12/30/12

12/30/12

12/30/12

After fourth growing season

Before pruning

Heavy pruning

Minimal pruning

Unheaded/unpruned

1/15/12

1/15/12

1/15/12

Heavy pruning

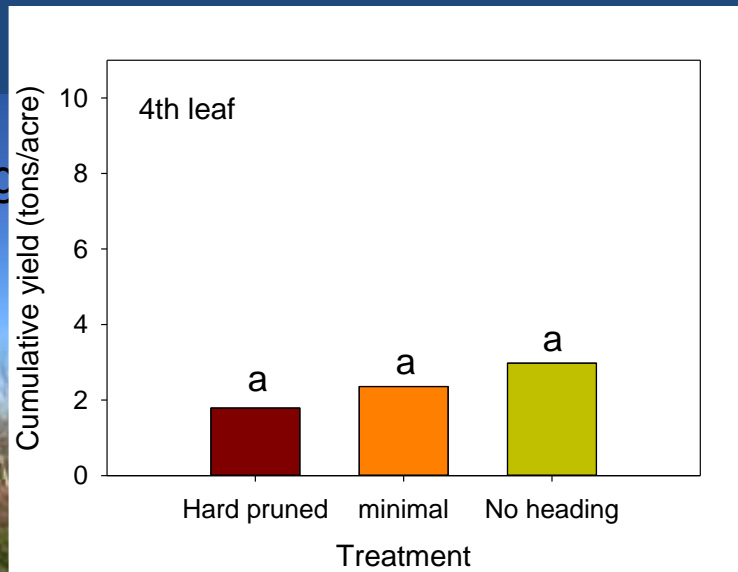
Unheaded/unpruned

12/30/12

12/30/12

12/30/12

After fourth growing season



Heavy pruning

Minimal pruning

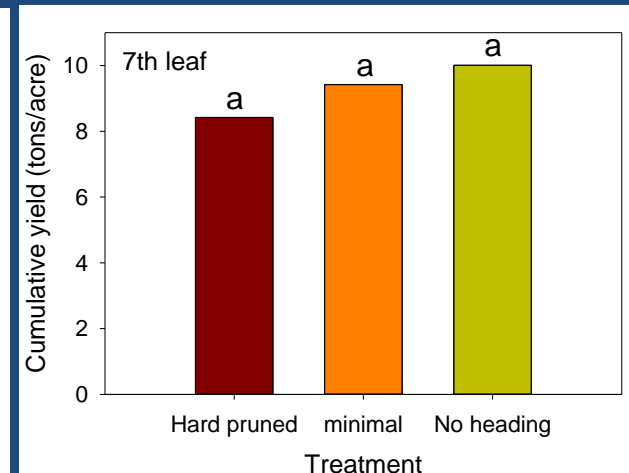
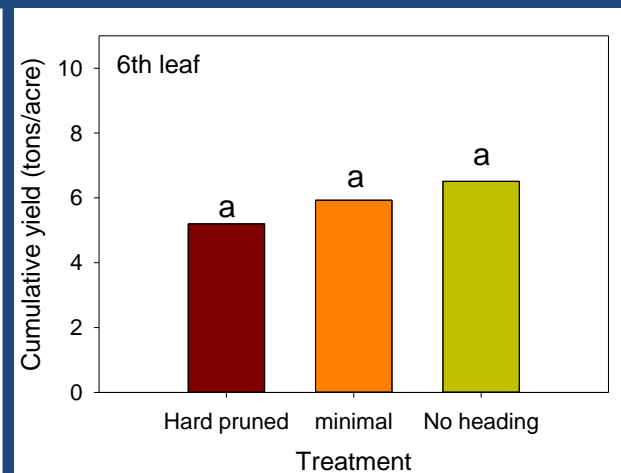
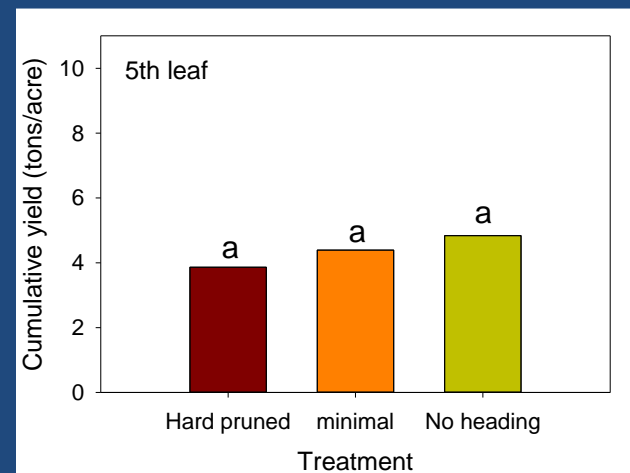
Unheaded/unpruned



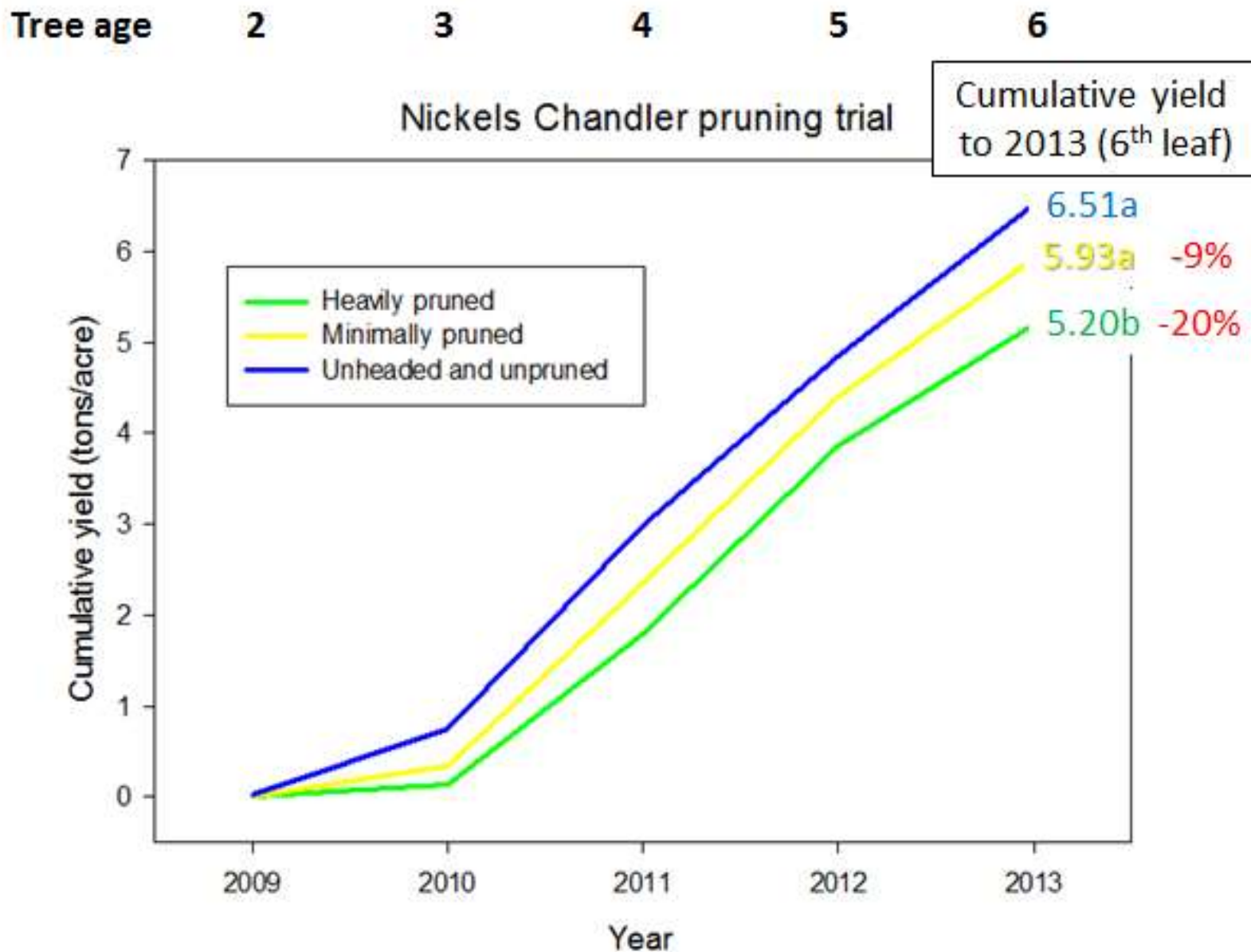
1/30/14

1/30/14

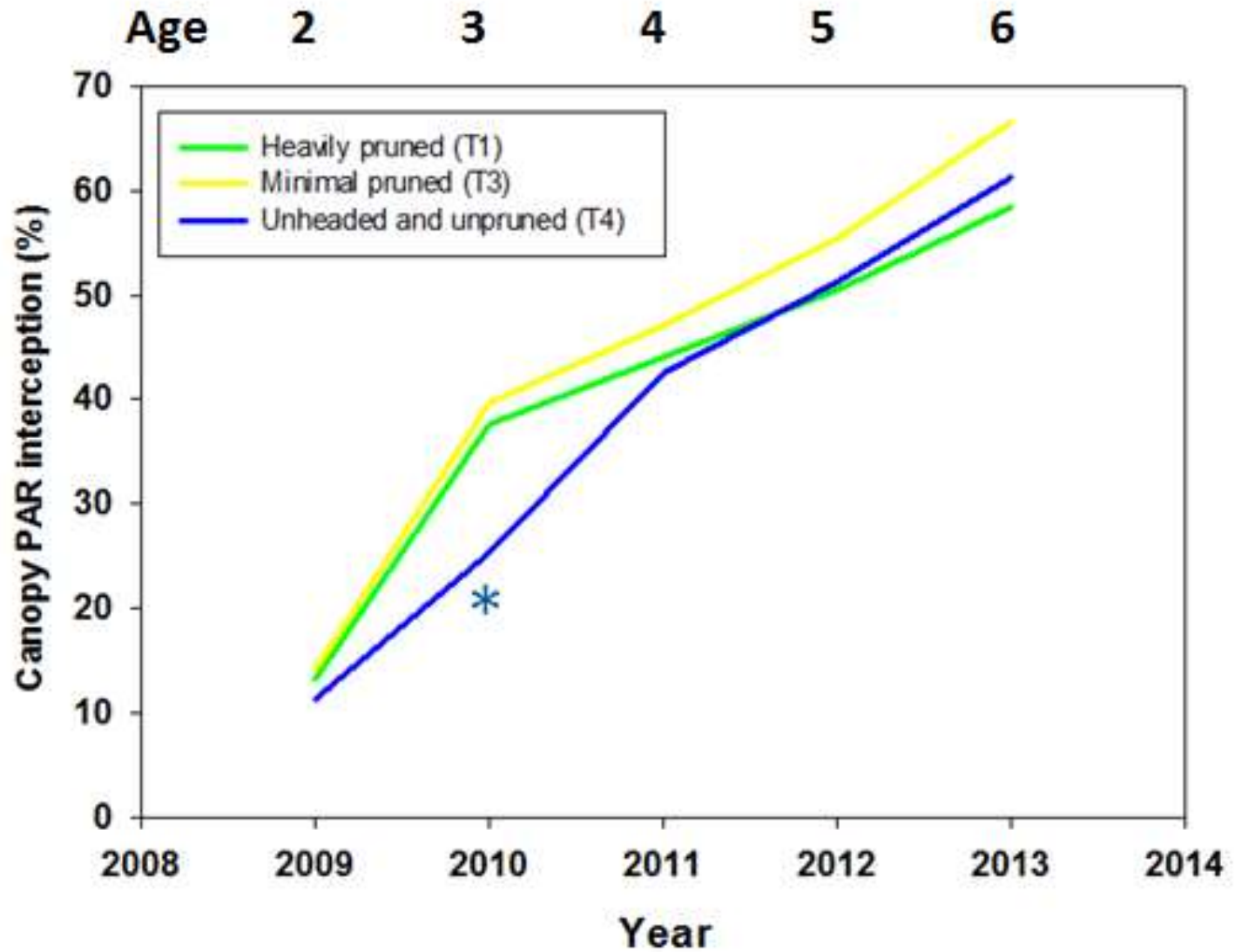
1/30/14

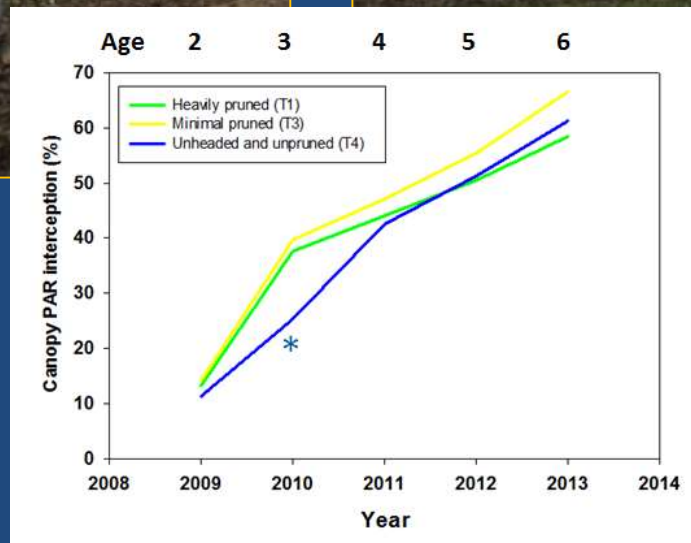


Cumulative yield by treatment and year for Chandler



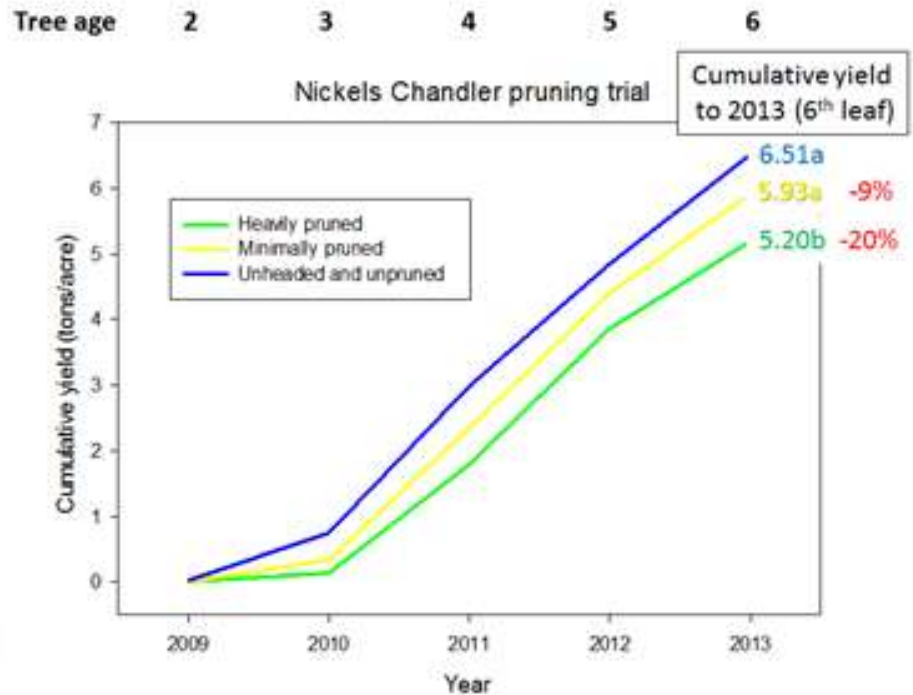
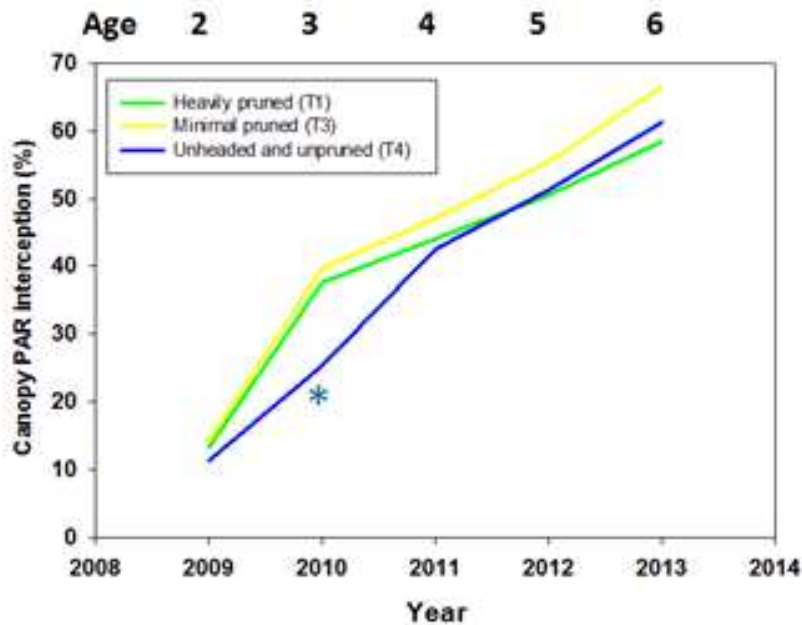
Midday canopy light interception by treatment and year for Chandler





- 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

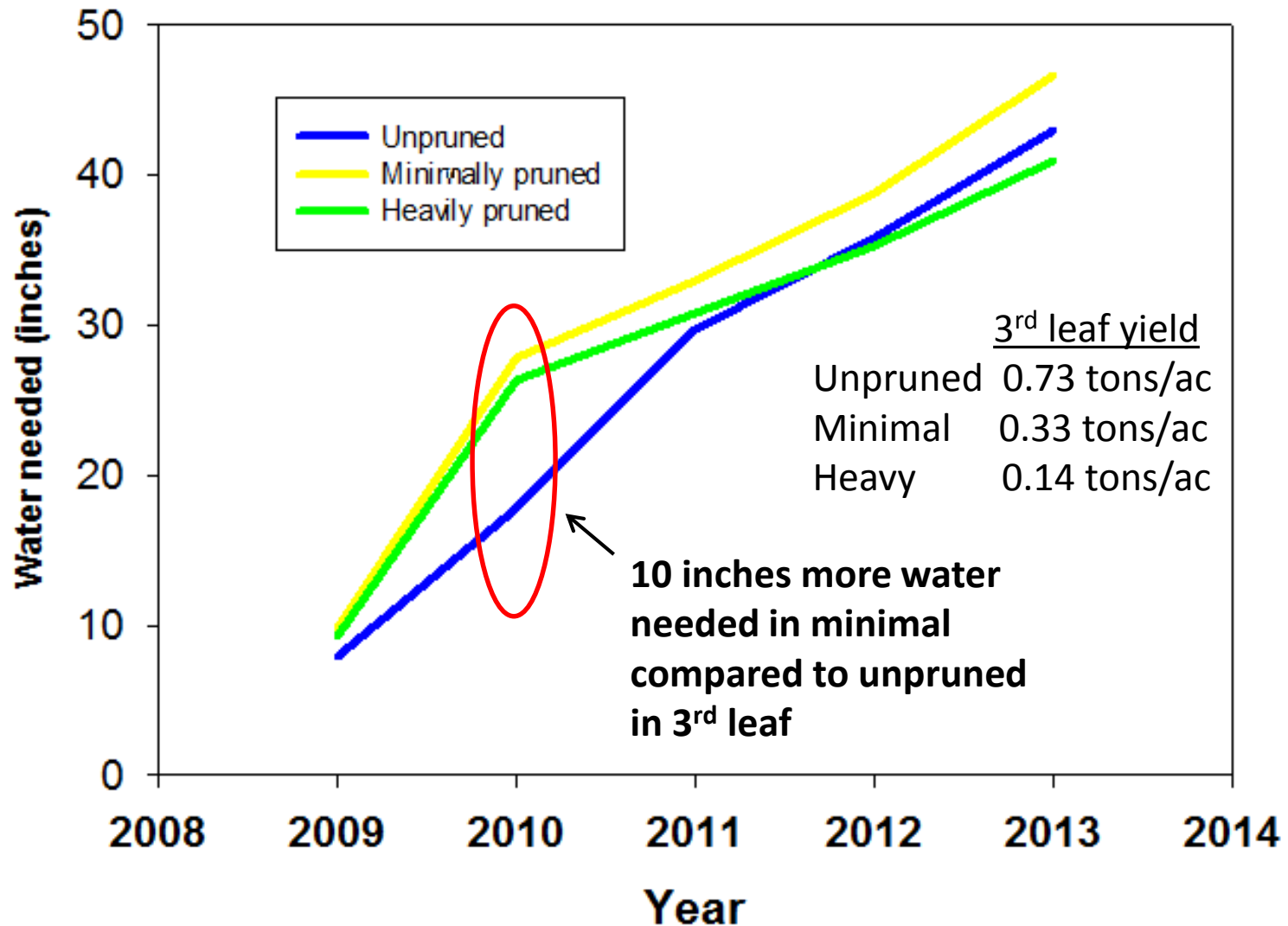
2

3

4

5

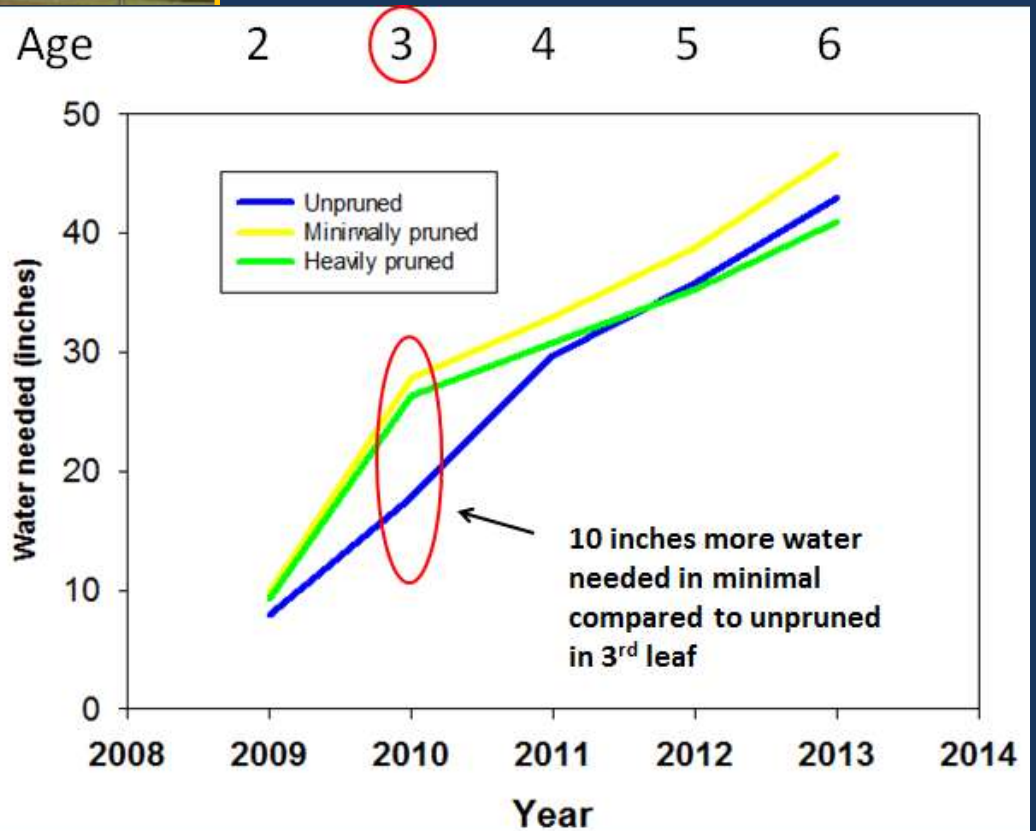
6





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

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

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

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
- 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

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

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
- There were no benefits to either minimal or heavy pruning in this trial

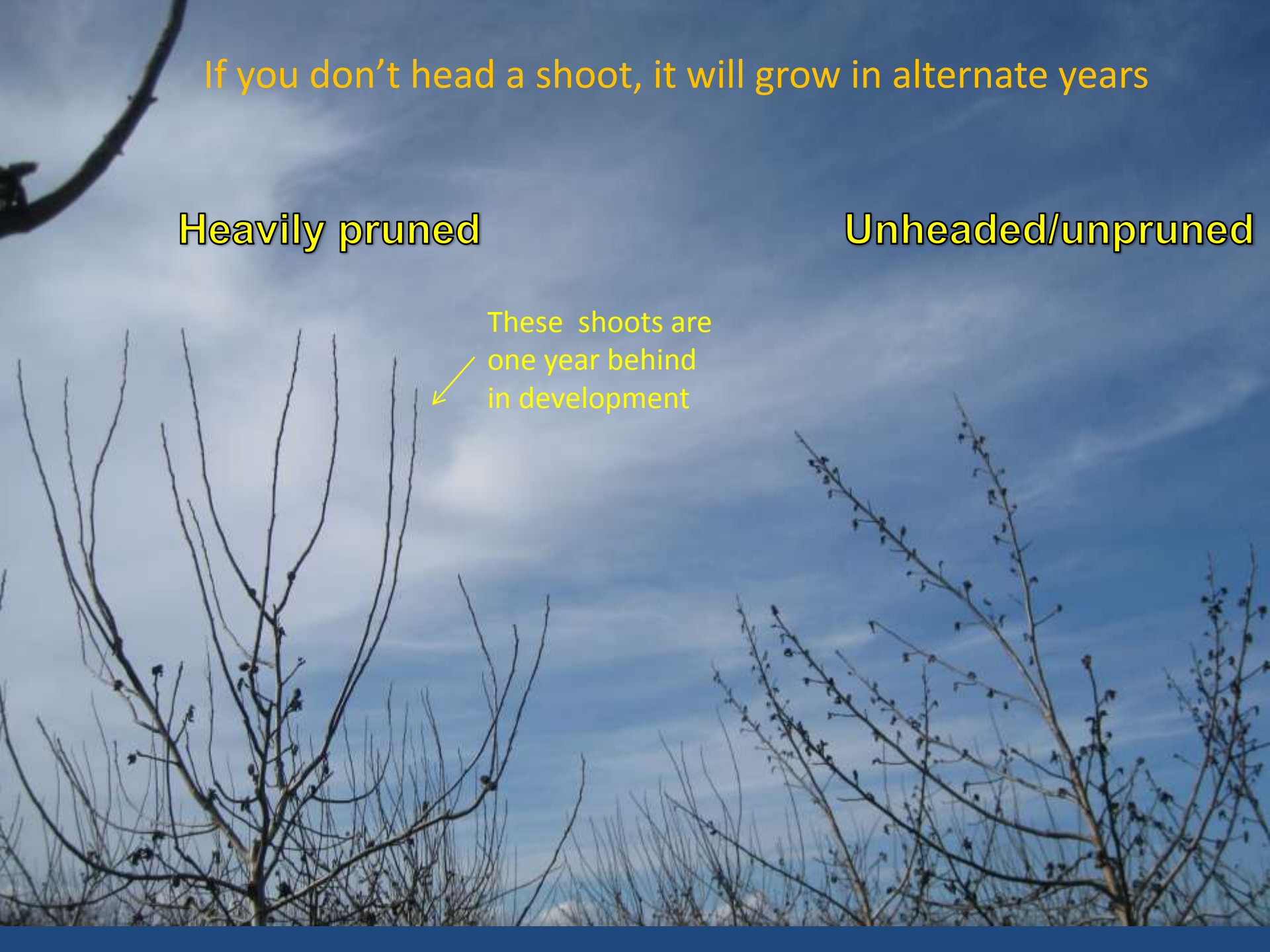
The Howard and Chandler pruned versus unpruned trials do not support the common wisdom that you need to prune walnuts to get them to grow and be productive

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



In 2012 through 2013

- Pruned versus unpruned trials initiated in grower orchards in Butte, Contra Costa, Lake, Merced and Tulare Counties

3rd Leaf own-rooted Chandler in Contra Costa County



Headed

Feb. 18, 2014



Unpruned

3rd Leaf Chandler in Lake County- moderate to severe cold damage on most trees in spring of 2013



Headed

PAR interception 6.4%



Unheaded, unpruned

7.3%

July 19, 2013

4th Leaf Forde in Butte County- Chico State Univ.



Oct. 12, 2013

PAR interception	Pruned	Unheaded, unpruned
	45.3%	46.2%

3rd Leaf Howard near Durham in Butte County



Trunk circumference (cm)

Headed
33.2

Unheaded/unpruned
33.7

3rd Leaf Chandler in Merced County



Headed

Unheaded, unpruned

PAR interc. (%)

24.8 a

23.9 a

Yield (lb/ac)

671 b

1348 a

3rd Leaf Chandler in Tulare County- grower stopped pruning trial after one year since yields were higher on unpruned



Yield (lbs/acre)
Headed
155



Unheaded, unpruned
174

How to train and prune using different methods

- Heavily pruned
- Minimally pruned
- Untrained/unpruned

Heavily pruned- don't do this



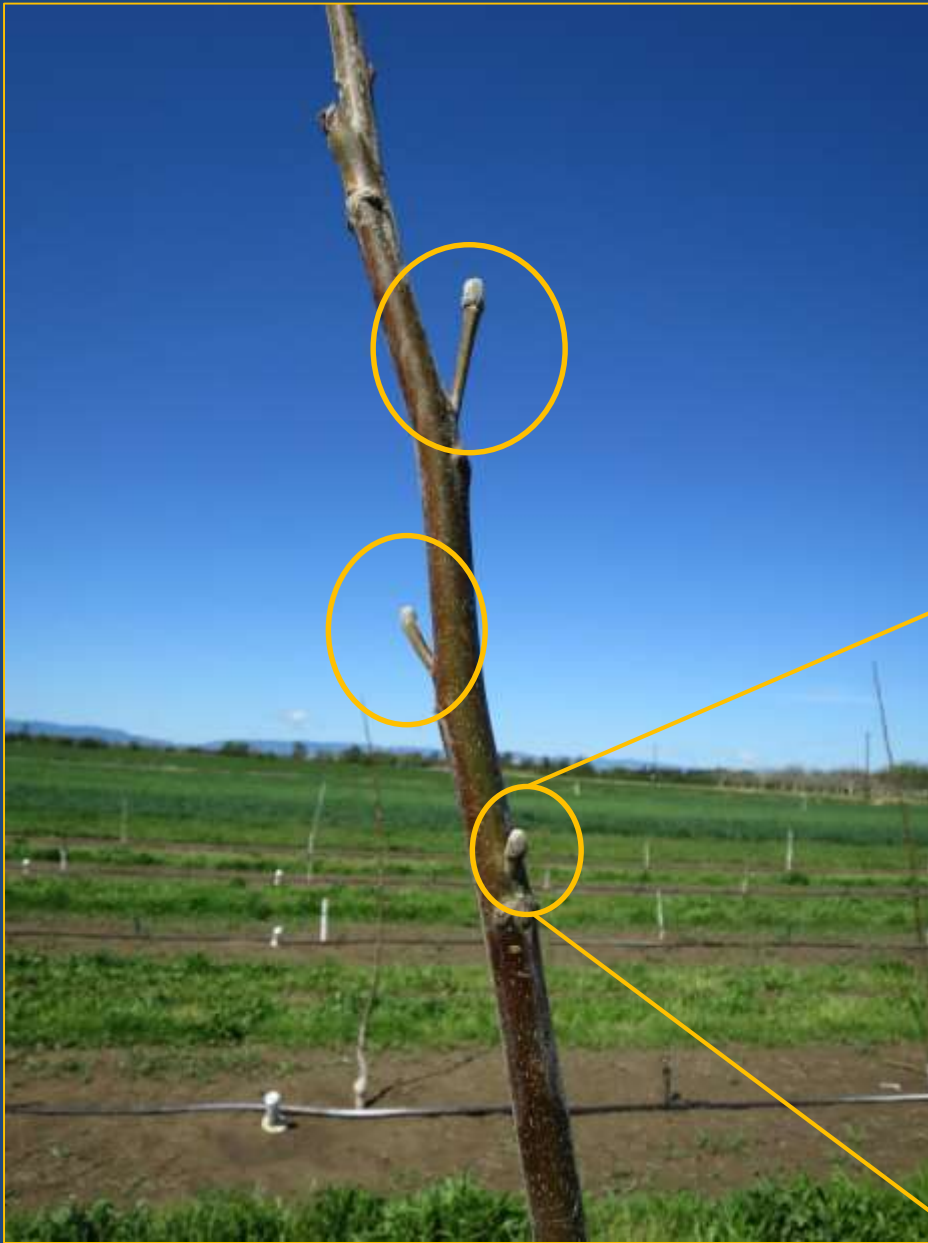
Minimal pruning- winter following 1st leaf



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



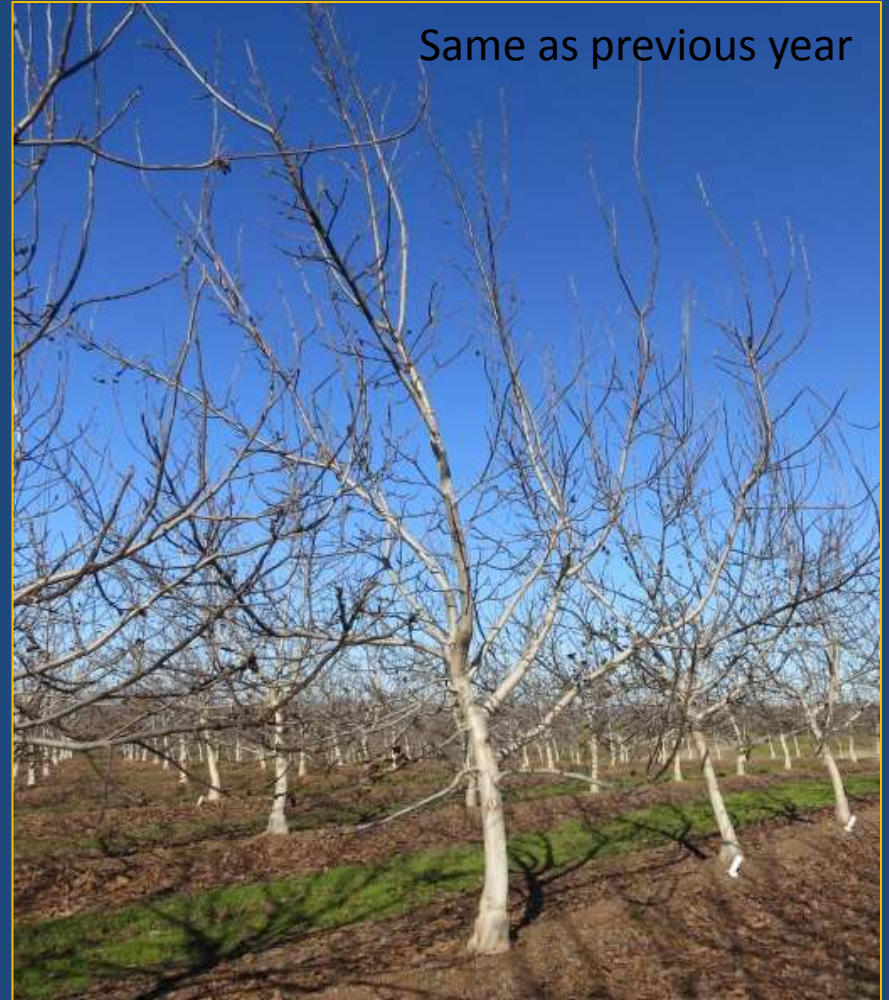
After pruning

Only head selected leader as well as 4-5 other branches destined to be main scaffolds (1/4 to 1/3 of previous years growth removed)

Minimal pruning- winter following 3rd leaf



Before pruning



After pruning

Untrained/unpruned- winter following 1st leaf

Singulate to single leader



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- do not head them but rather remove entirely to main trunk

Untrained/unpruned- winter following 3rd leaf on

Watch them grow in summer and go skiing in winter



3rd



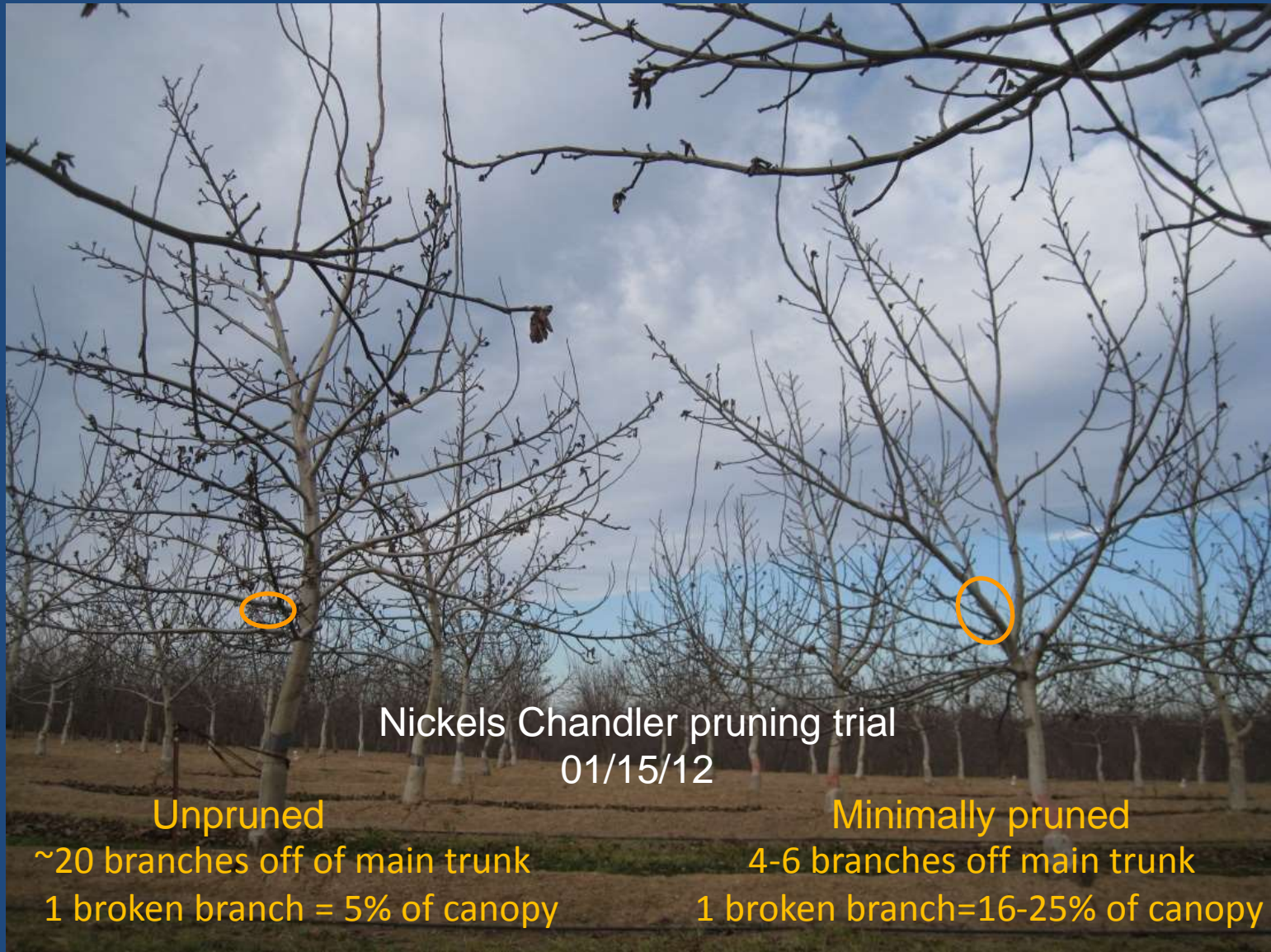
4th



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

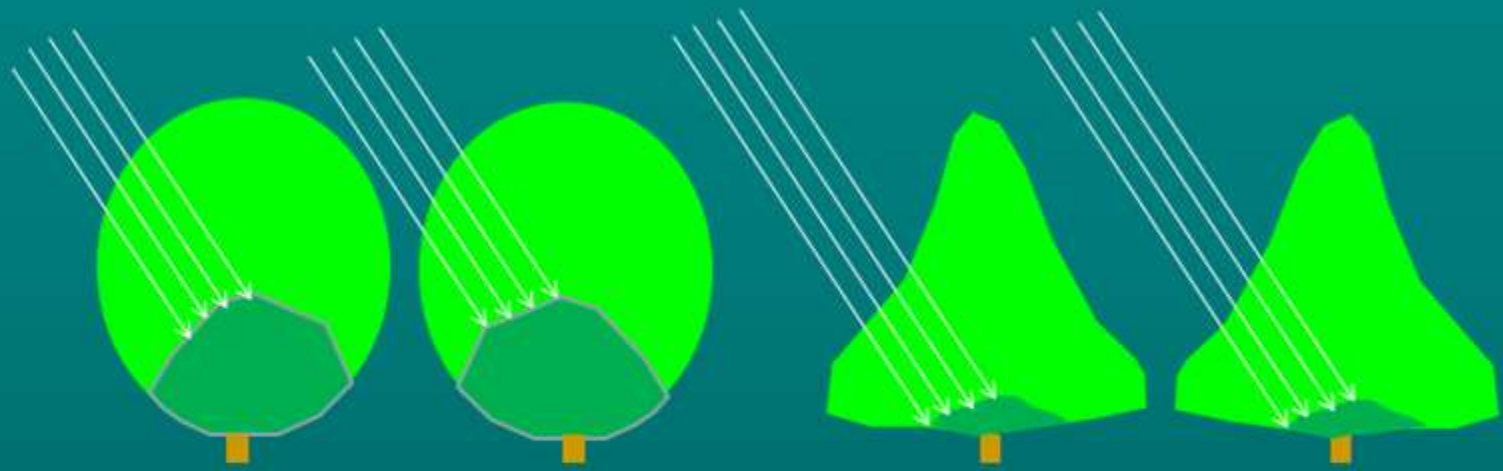
Shading related dieback will occur earlier

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

Yellow pellicles



Bronze pellicles



Shrivel



Black pellicles



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

Nickels Chandler Pruning Trial Field Day

Heavy pruning

Minimal pruning

Unheaded/unpruned



1/30/14

1/30/14

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?

