



Are We “Overtraining” Young
Walnuts?
&
The Cause for Oilless/black Walnuts

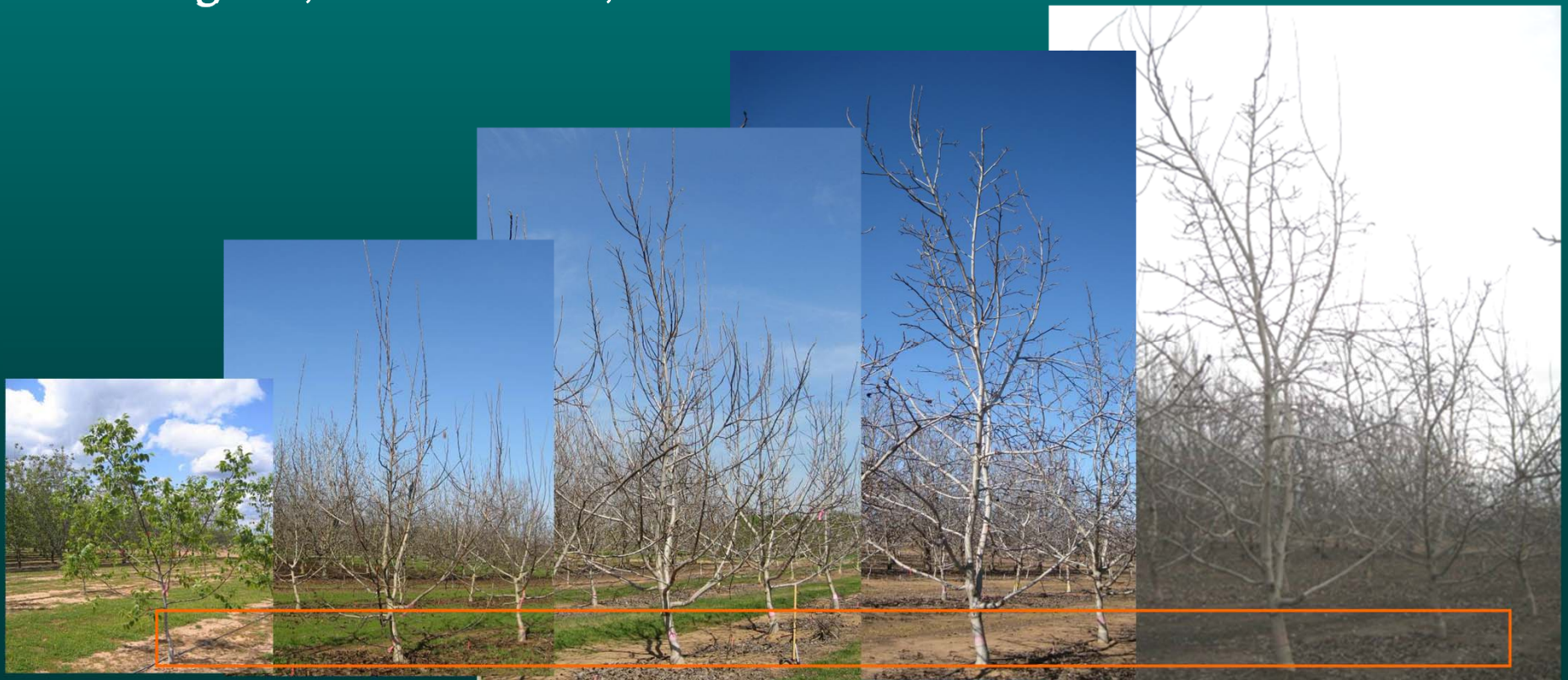
Bruce Lampinen, Extension Specialist, Department of Plant
Sciences, UC Davis

3 trials

- Howard pruned versus unpruned trial (2004-2010)
- Chandler pruning trial (2009 to present)
- Walnut quality study

Comparison of Growth and Productivity of Pruned and Unpruned 'Howard' Walnut Trees as Impacted by Crop Load

Bruce Lampinen, John Edstrom, Sam Metcalf, Claudia Negrón, Bill Stewart, Loreto Contador and Stan Cutter



Pruning treatments imposed in March 2004 14' x 21' spacing

Treatment 1- unpruned, no fruit
removal

Treatment 2- unpruned, with fruit
removal

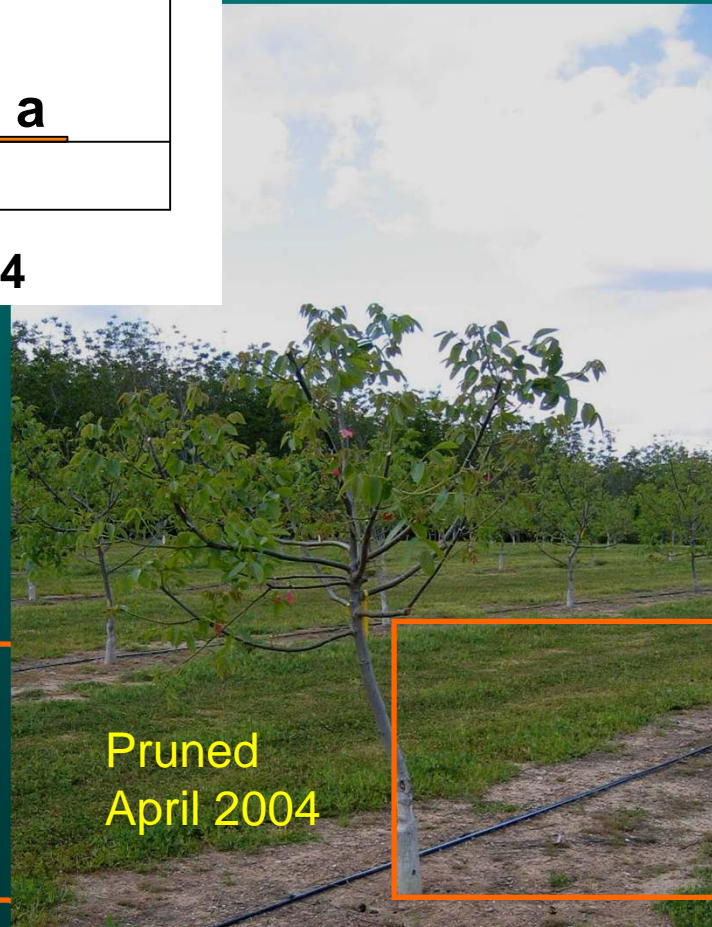
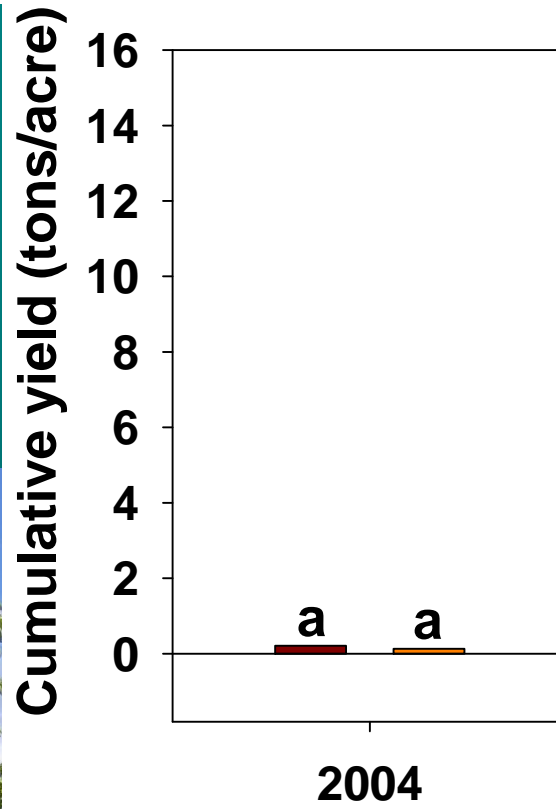
Treatment 3- pruned off 1/3 of
previous season growth
each year until tree fills
allotted space, no fruit
removal

Treatment 4- pruned as in treatment
3 with fruit removal.

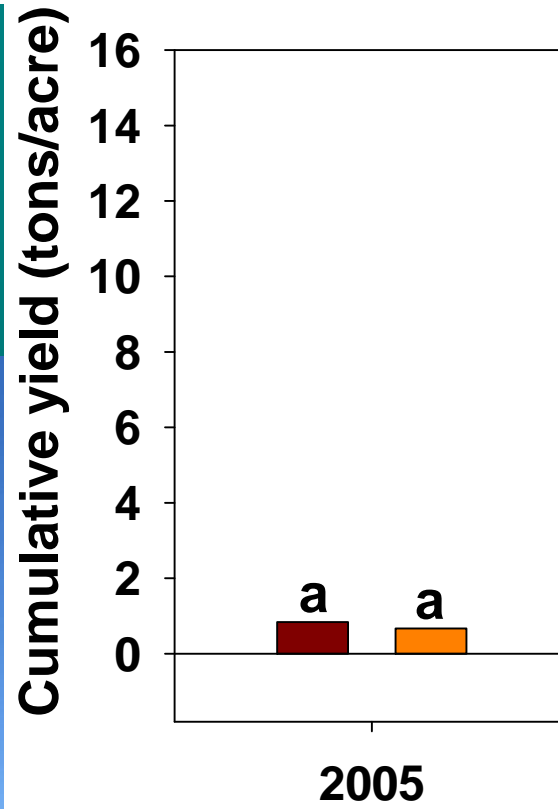
Treatment 5- pruned in 2004,
unpruned in 2005-2007,
mechanically hedged in
2008



April 2004



March 2005

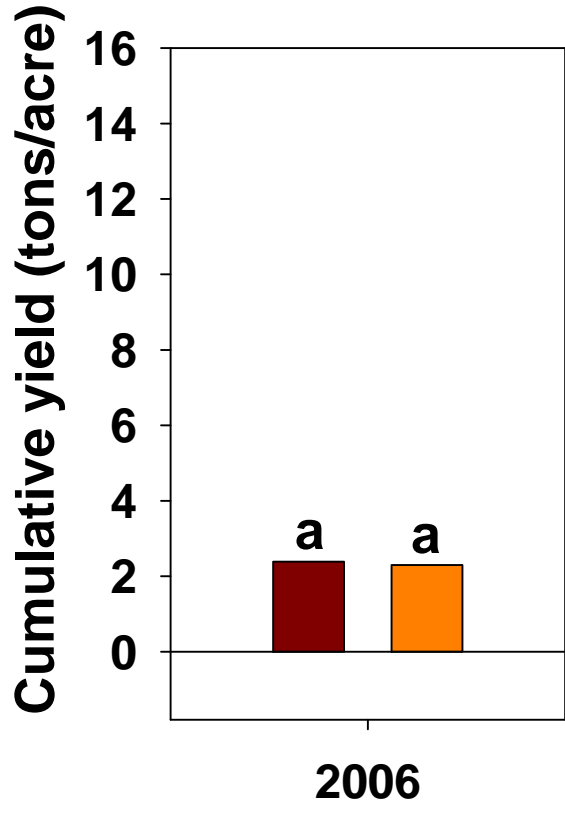


Unpruned

Pruned



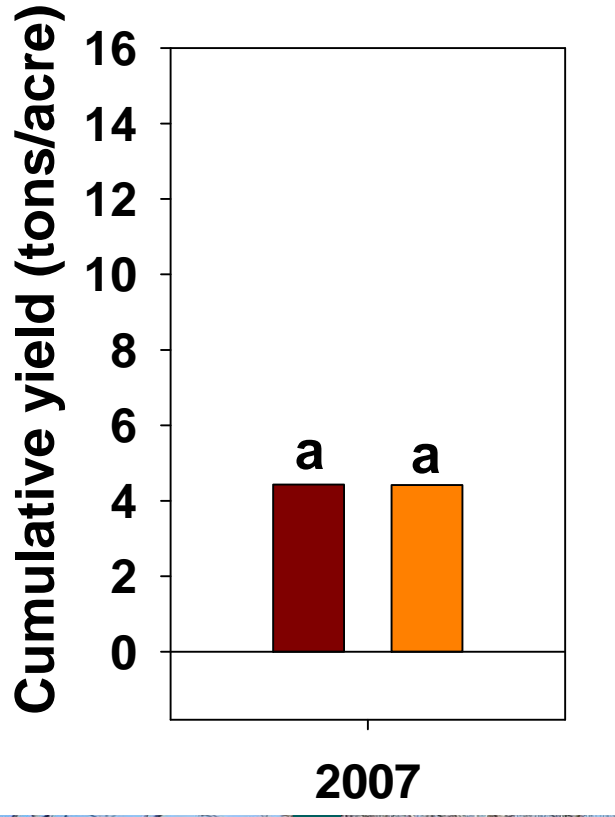
Unpruned



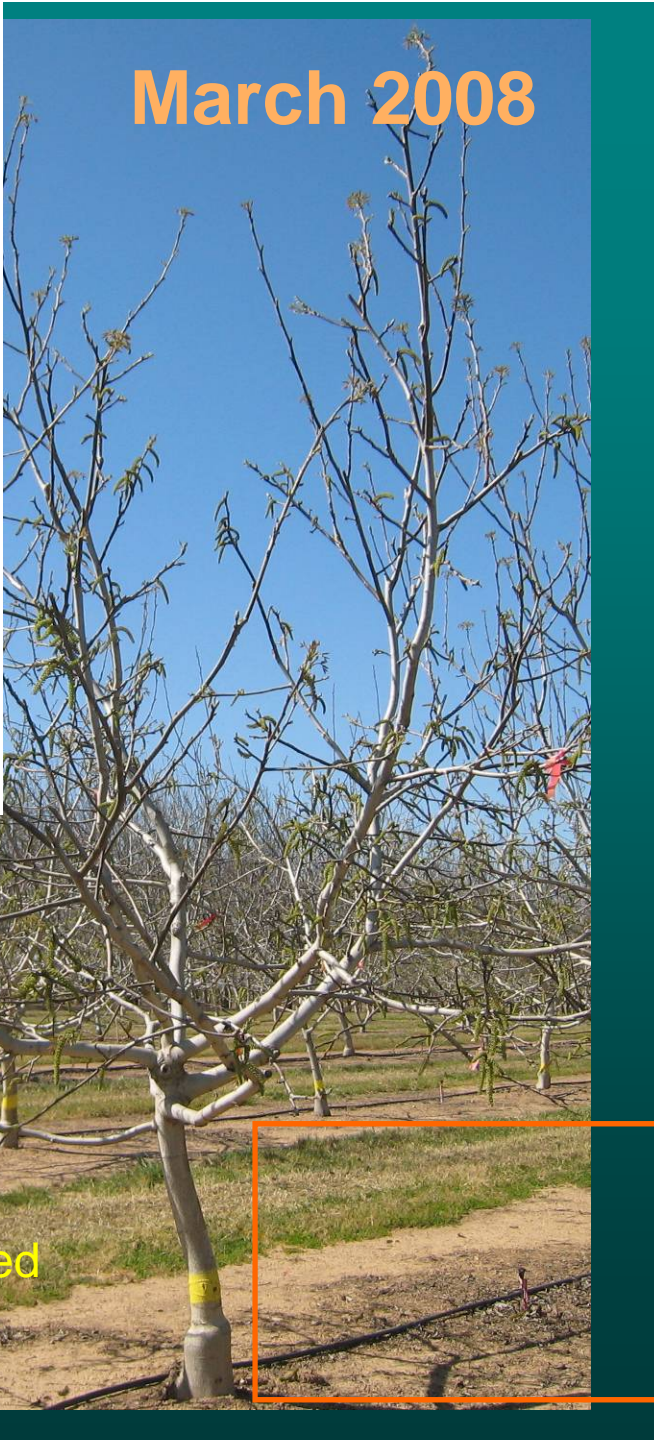
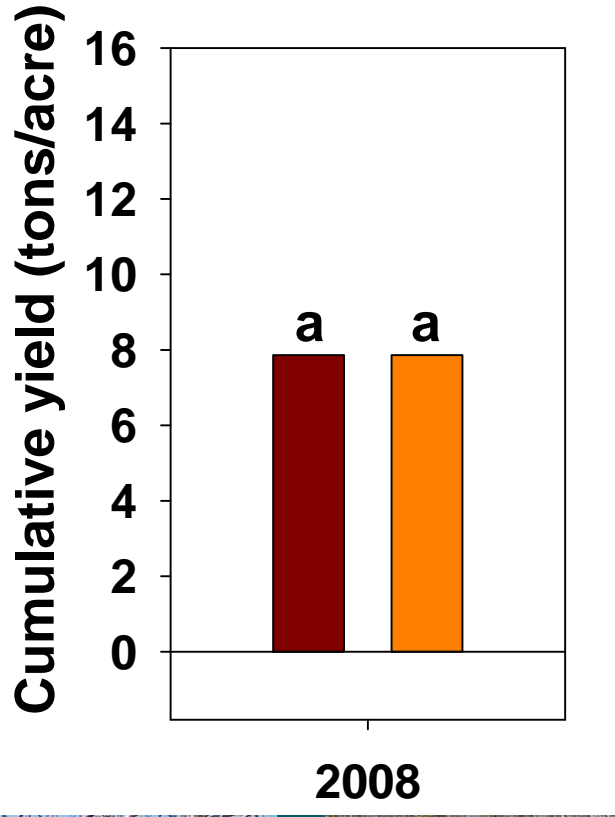
March 2006



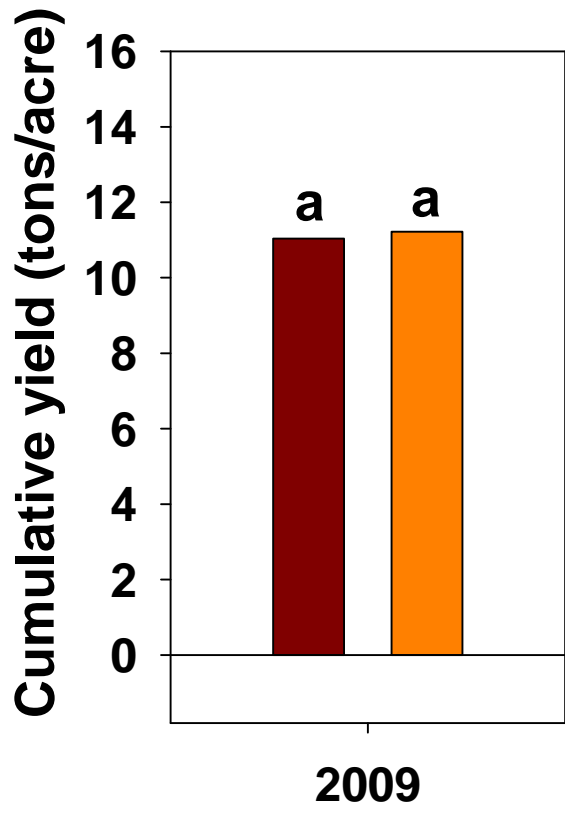
Pruned



March 2007

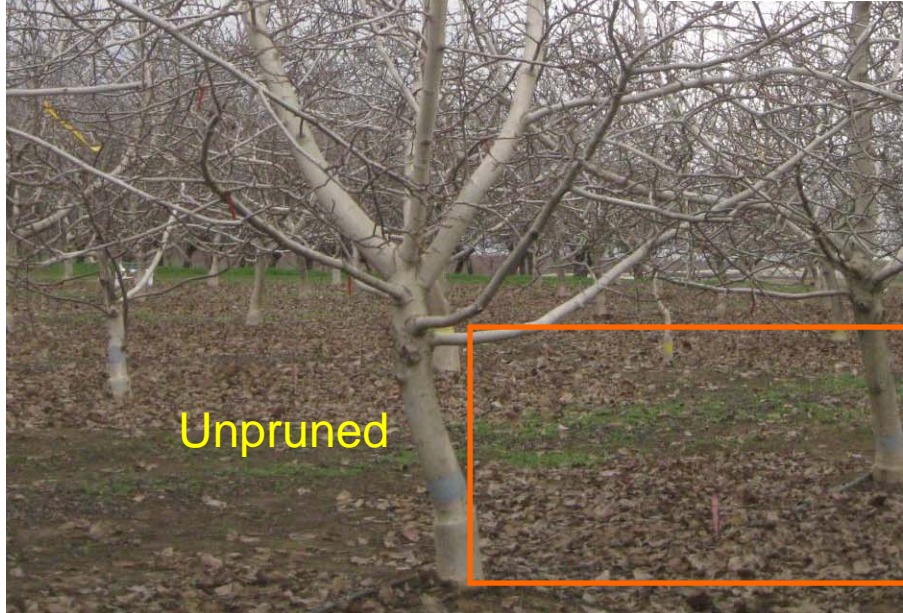
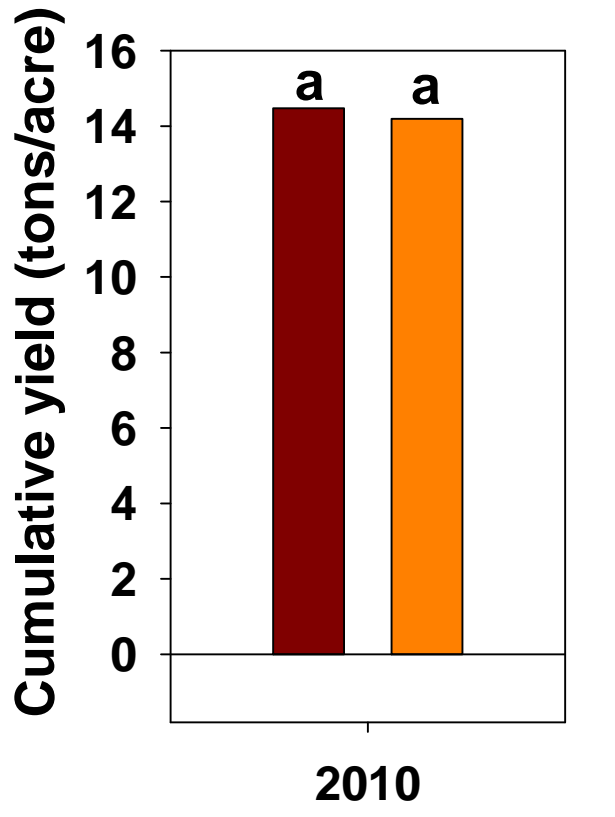


February 2009



Unpruned

Pruned



Jan. 2011



Unpruned



Pruned



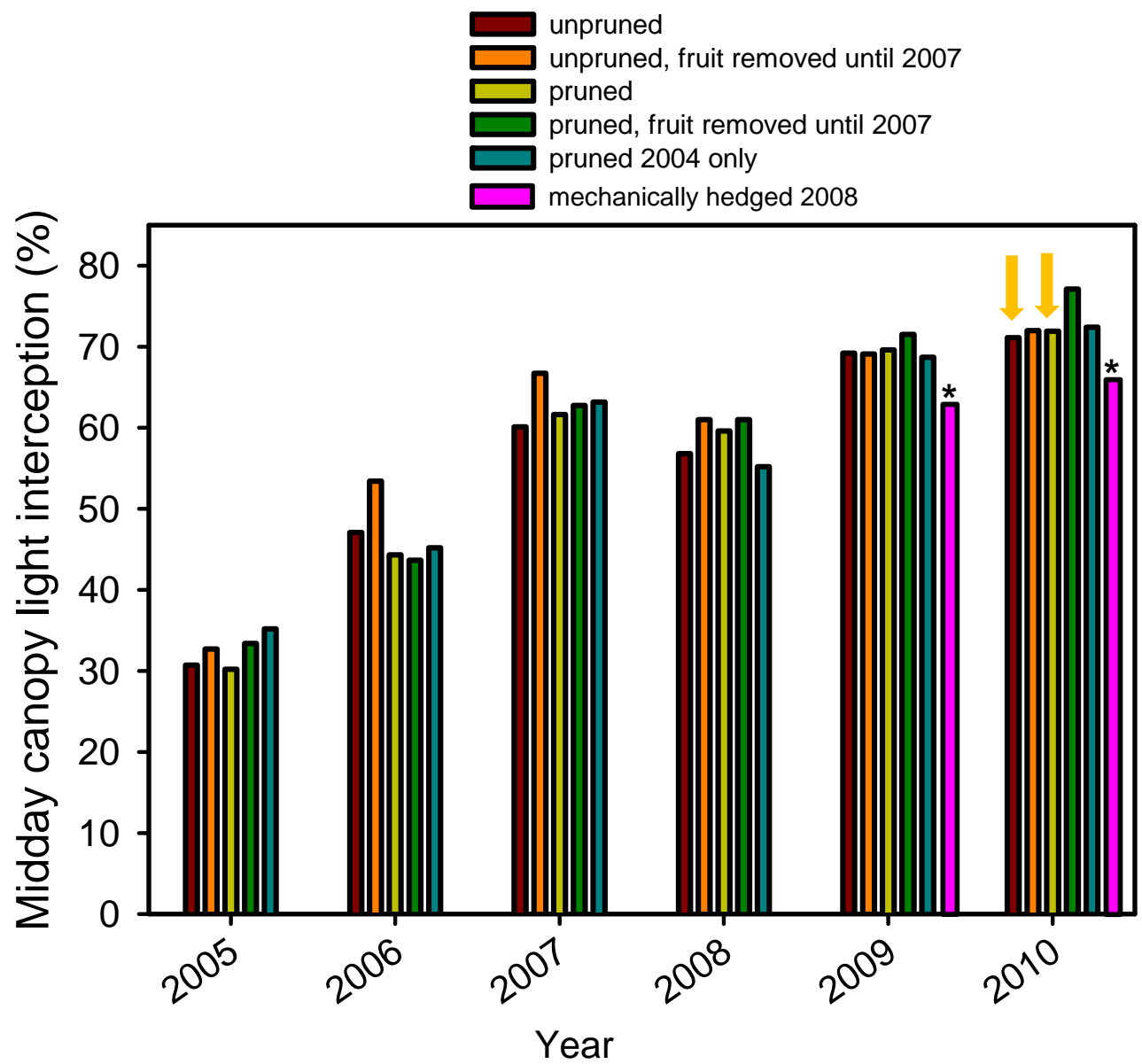
4/16/04

1/9/06

3/15/07

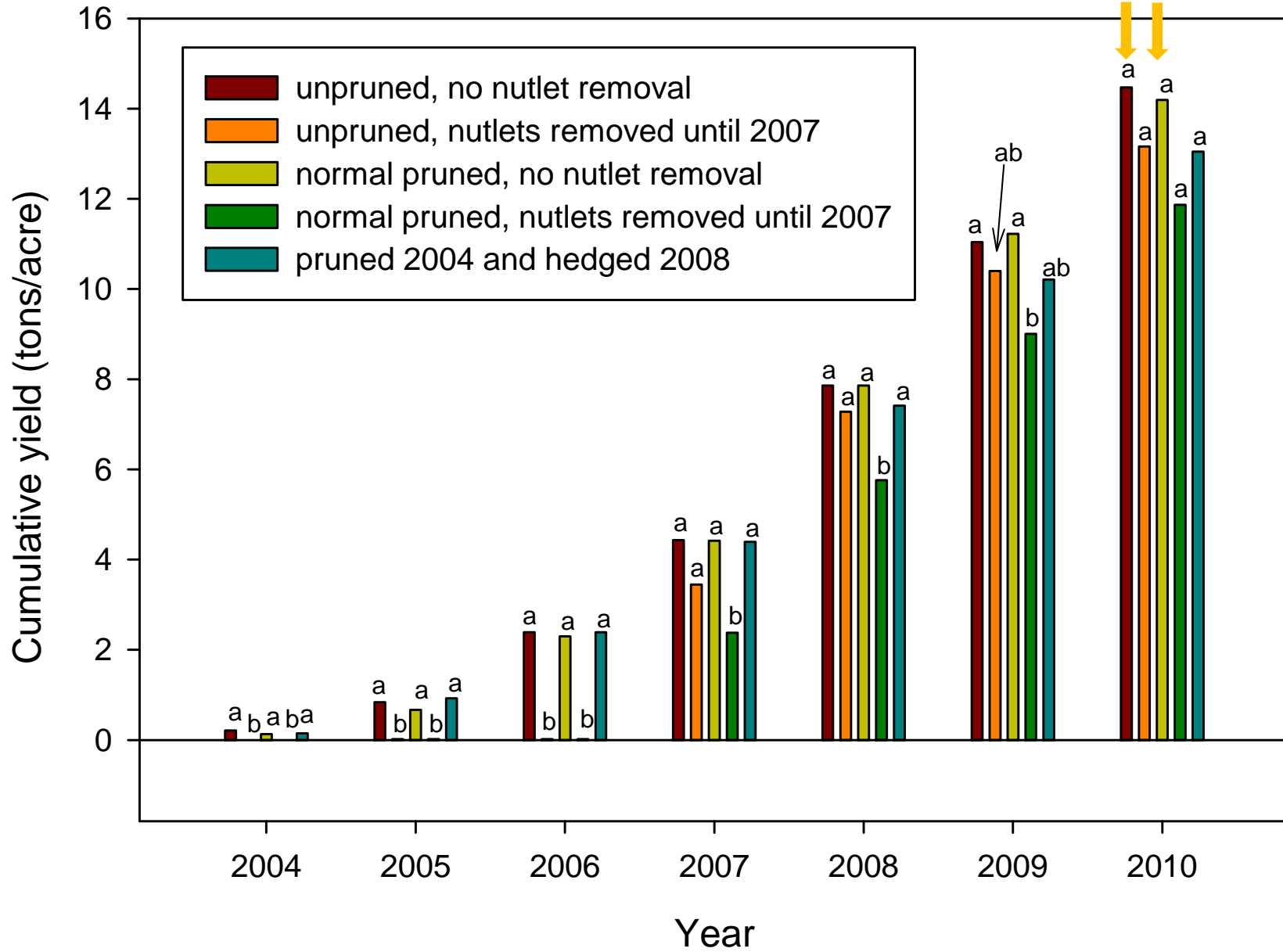
2/9/09

1/12/10



*no significant differences between treatments in any year (except significantly less for mechanically hedged in 2009 and 2010)

Nickels Howard Pruning Trial Cumulative yield 2004-2010



After 7 years of treatment imposition

- Pruned versus unpruned- no significant differences in:
 - Tree size
 - Midday canopy light interception
 - Cumulative yield
 - Percent sunburn
 - Nut quality- except more large in unpruned in 2008
- Crop removal stimulated vegetative growth but did not result in significant increase in midday canopy light interception



Nickels Soil Lab Chandler Walnut Hedgerow Pruning Trial

Carolyn DeBuse, John Edstrom, Janine
Hasey, and Bruce Lampinen

Design and Pruning treatments

- **Chandler orchard planted at 15 x 22 ft.**
- **Planted 2008**
- **Nursery budded on Paradox rootstock**
- **March 2009 first pruning**
- **Treatments**
 - 1) Heavily pruned hedgerow**
 - 2) Minimal hedgerow/low vigor training**
 - 3) Minimal hedgerow training**
 - 4) No heading/pruning training**

Heavy pruning



3/23/09

Moderate pruning



3/23/09

Unheaded/unpruned



3/23/09

Heavy pruning



12/16/09

Moderate pruning



12/16/09

Unheaded/unpruned



12/16/09

Heavy pruning

Moderate pruning

Unheaded/unpruned



1/15/12

1/15/12

1/15/12

Results

Average circumference at 2 feet above ground (cm)

Treatment	March 2009	Dec. 2009	Nov. 2010	Nov 2011
Heavily pruned (T1)	8.25 a	20.4 a	27.9 b	34.5 b
Minimal/low vigor (T2)	8.25 a	21.7 a	32.0 a	37.9 a
Minimally pruned (T3)	7.89 a	20.3 a	29.7 ab	37.2 a
No heading/pruning (T4)	8.17 a	20.9 a	30.4 a	37.5 a

Results

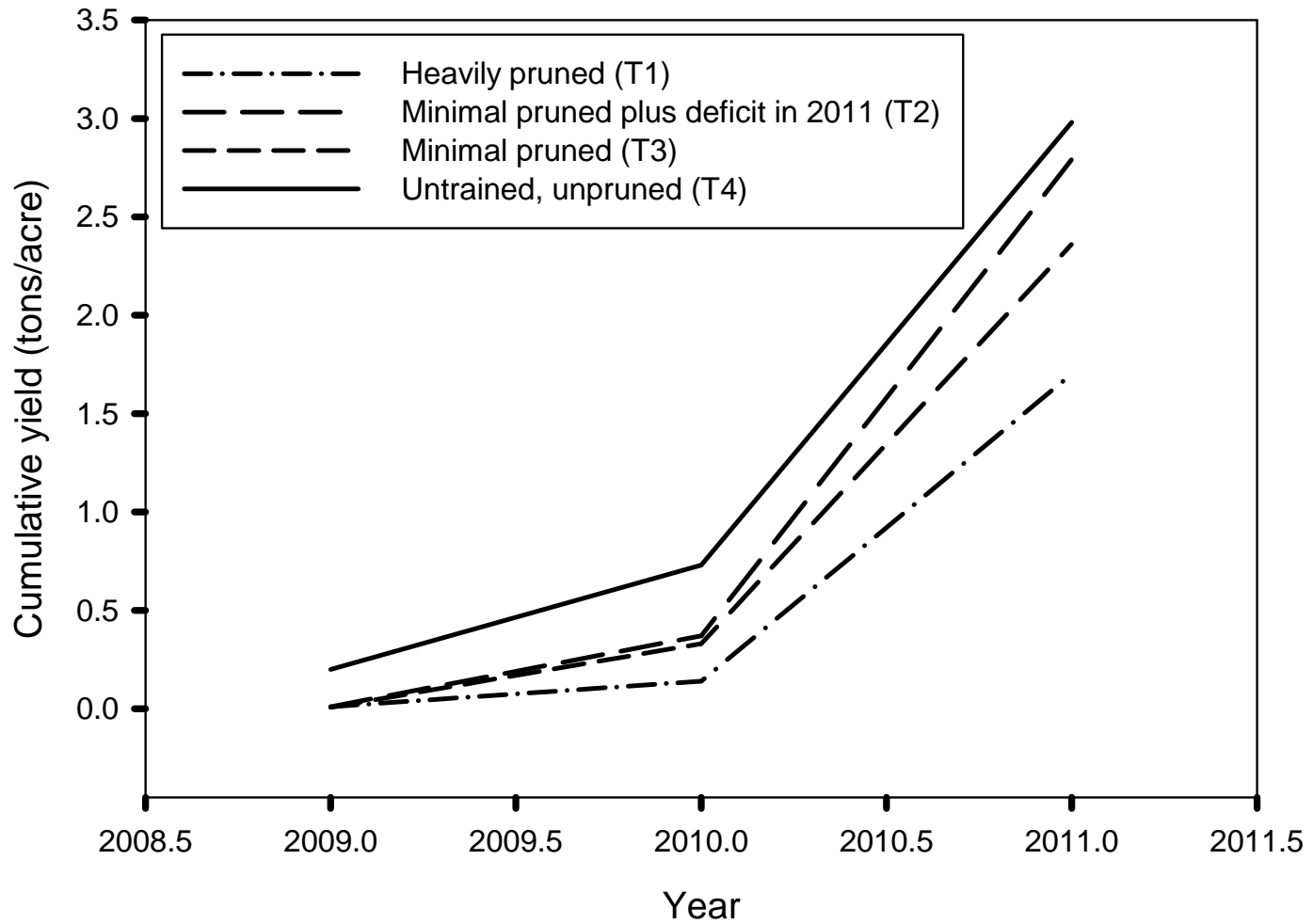
Average Height (cm)				
Treatment	March 2009	Dec 2009	Nov 2010	Nov 2011
Heavily pruned (T1)	192.2 b	389.4 c	468.2 c	557.8 a
Minimal/low vigor (T2)	197.2 b	421.1 b	525.2 a	561.4 a
Minimally pruned (T3)	190.6 b	389.6 c	510.9 ab	584.7 a
No heading/pruning (T4)	280.4 a	481.6 a	480.8 bc	591.5 a

Results

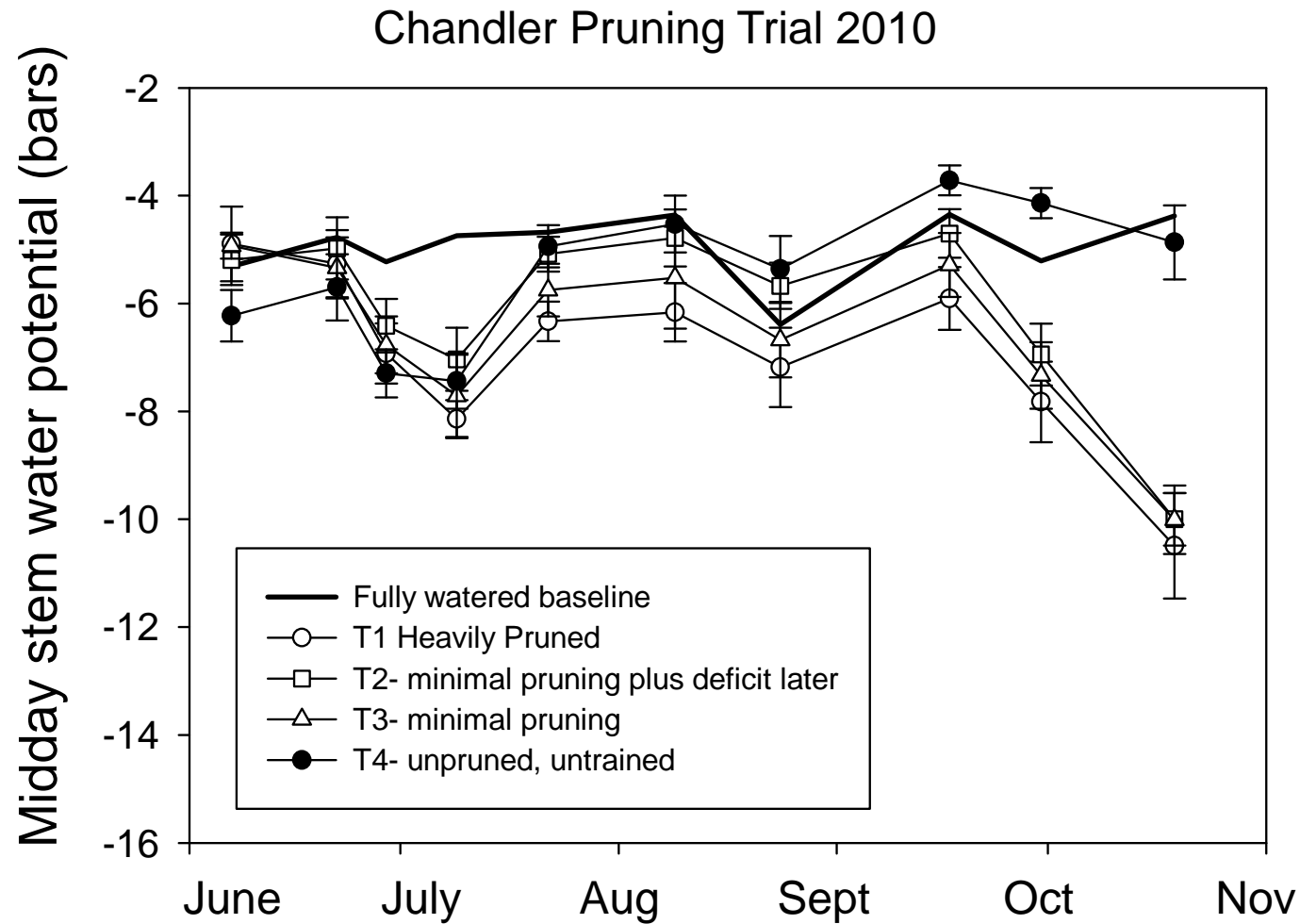
Comparing average canopy PAR interception with yield

Treatment	2011 PAR intercept (%)	2011 yield (tons/acre)	2011 yield per unit PAR intercepted	Cumulative yield (tons/acre)
Heavily pruned (T1)	32.4 a	1.64 b	0.051 b	1.70 b
Minimal/low vigor (T2)	39.0 a	2.41 a	0.062 ab	2.79 a
Minimally pruned (T3)	38.5 a	2.02 ab	0.052 b	2.36 ab
No heading/pruning (T4)	32.8 a	2.23 ab	0.068 a	2.98 a

Cumulative yield by treatment and year for Chandler

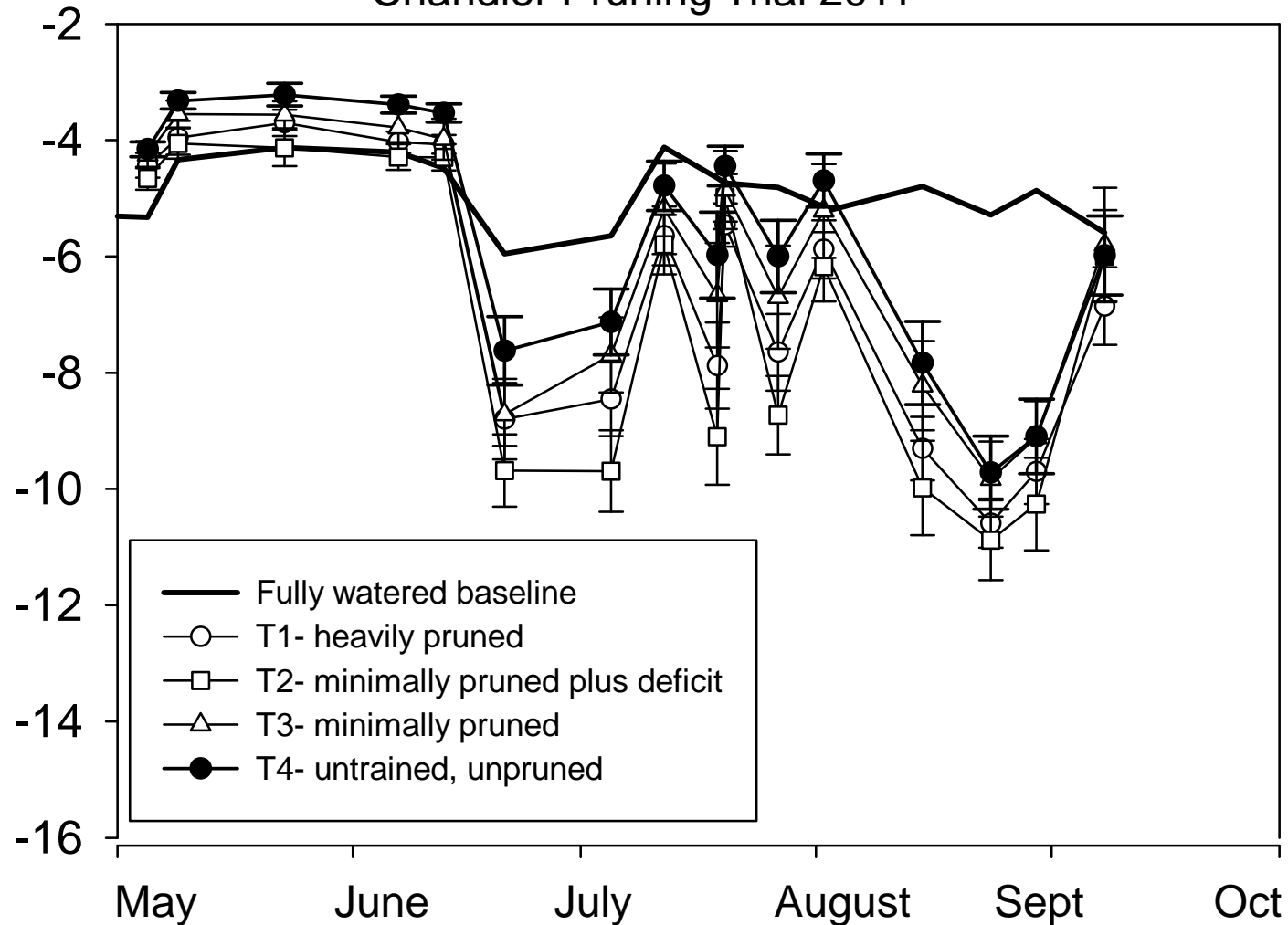


Water Status compared between pruning treatments



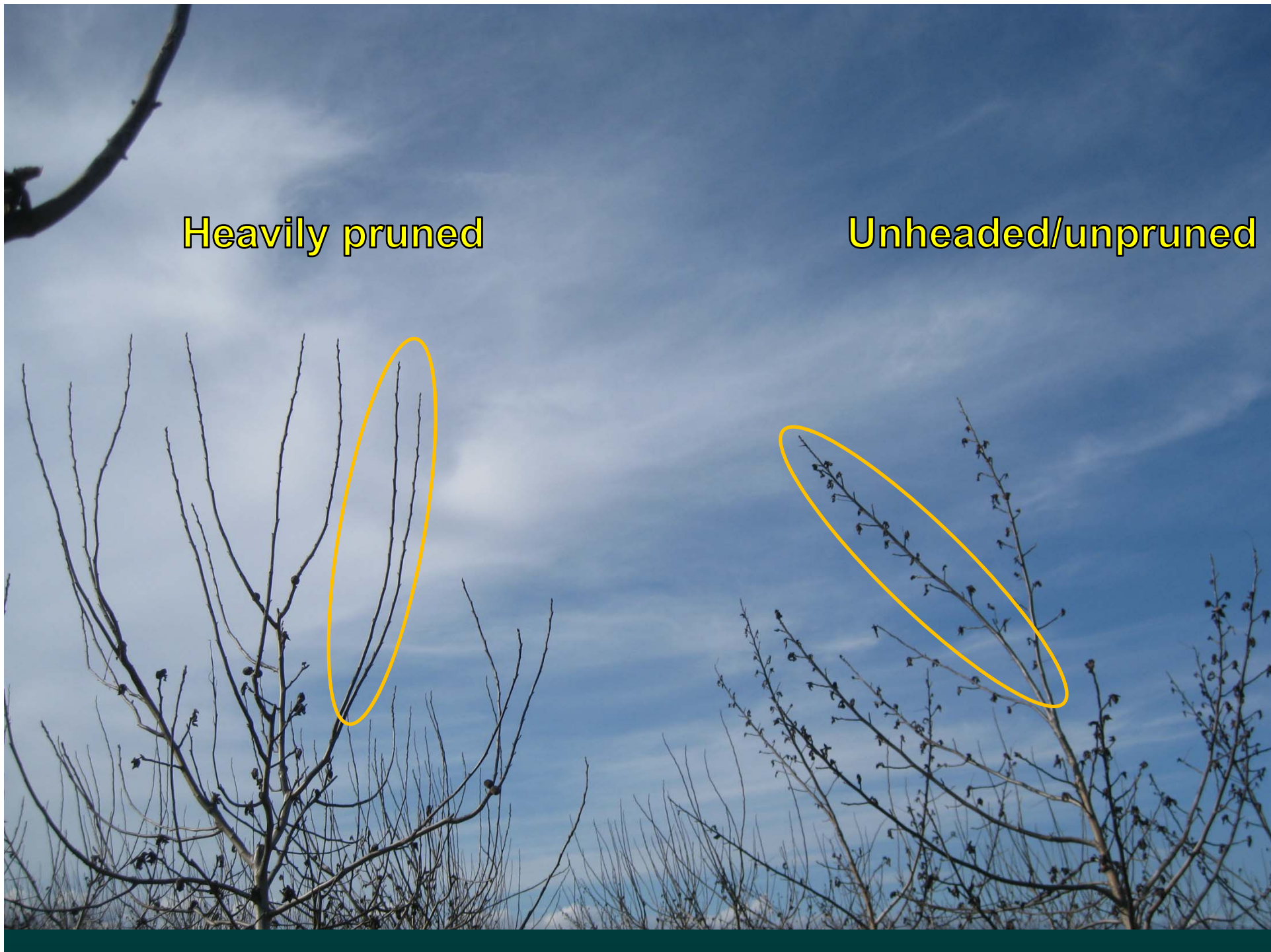
Water Status compared between pruning treatments

Chandler Pruning Trial 2011



Heavily pruned

Unheaded/unpruned



unpruned

Minimum pruned



3 HOURS

PLANTCAM

APR.01,11 12:00 PM

unpruned

Minimum pruned



3 HOURS

PLANTCAM

APR.15,11 12:00 PM

unpruned

Minimum pruned



3 HOURS

PLANTCAM

MAY.04,11 01:23 PM

unpruned

Minimum pruned



3 HOURS

PLANTCAM

MAY.15,11 12:00 PM

unpruned

Minimum pruned



3 HOURS

PLANTCAM

MAY.29,11 12:00 PM

unpruned

Minimum pruned



3 HOURS

PLANTCAM

JUN.15,11 12:00 PM

unpruned

Minimum pruned



3 HOURS

PLANTCAM

JUN.30,11 12:00 PM

unpruned

Minimum pruned



3 HOURS

PLANTCAM

JUL.15,11 12:00 PM

unpruned

Minimum pruned



3 HOURS

PLANTCAM

JUL.30,11 12:00 PM

unpruned

Minimum pruned



3 HOURS

PLANTCAM

AUG.15,11 12:00 PM

unpruned

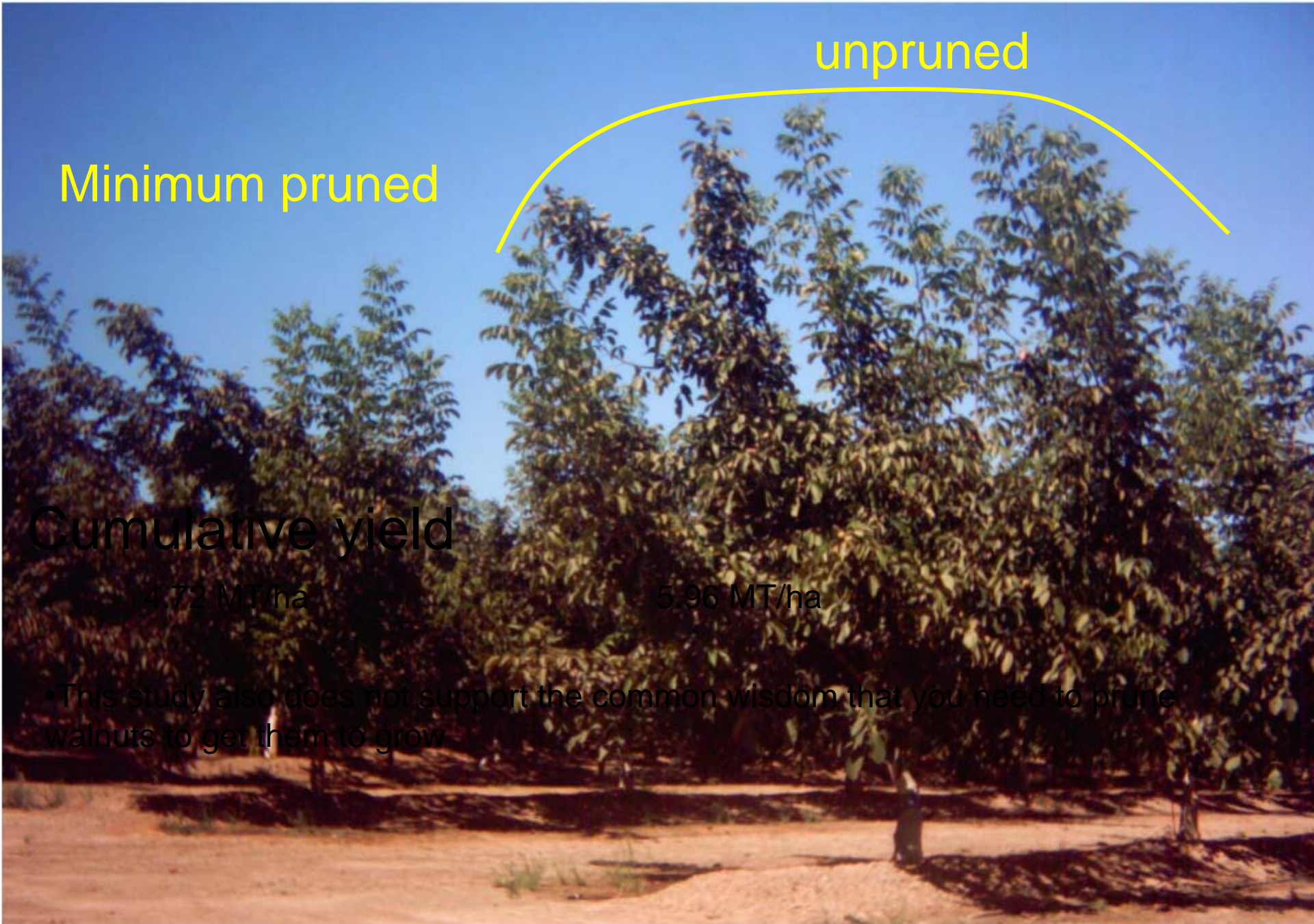
Minimum pruned



3 HOURS

PLANTCAM

SEP.01,11 12:00 PM



unpruned

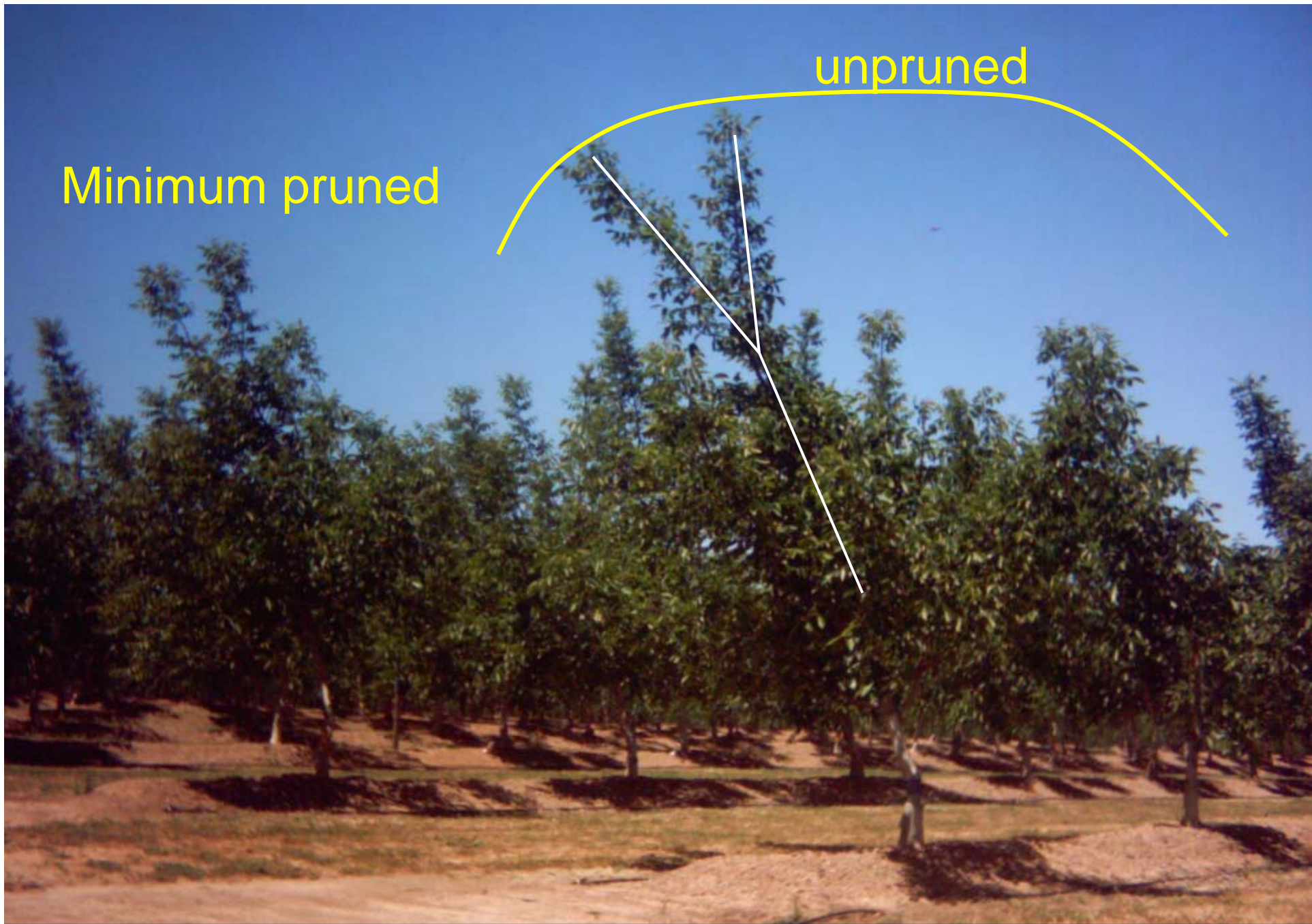
Minimum pruned

Cumulative yield

4.72 MT/ha

5.96 MT/ha

•This study also does not support the common wisdom that you need to prune walnuts to get them to grow



unpruned

Minimum pruned

3 HOURS PLANTCAM MAY.10,11 12:02 PM



Minimum pruned

unpruned

3 HOURS

PLANTCAM

OCT.19,11 12:00 PM

Preliminary Results

- **Unpruned treatment had higher July midday canopy light interception compared to minimal or heavy pruning treatment in 2010 and all were similar in 2011**
- **Unpruned treatment has produced significantly higher cumulative yields compared to either pruning treatment**
- **Unpruned treatment had significantly less stress late in season compared to either pruning treatment in 2010**

Pruning/training preliminary conclusions

- **There is little hard data to support current pruning recommendations for walnut**
- **Trending towards less pruning (potentially unpruned orchards) can result in increased early yields and decreased costs for pruning, burning/grinding, etc.**
- **Unpruned trees may need to have different water management than pruned so may be difficult to try a few rows of unpruned trees in a normally pruned orchard**

2011 Walnut Quality Problems and Potential Causes

Bruce Lampinen

**Integrated Orchard Management Specialist
UC Davis**



Thin shell



Yellow pellicle



Bronze pellicle



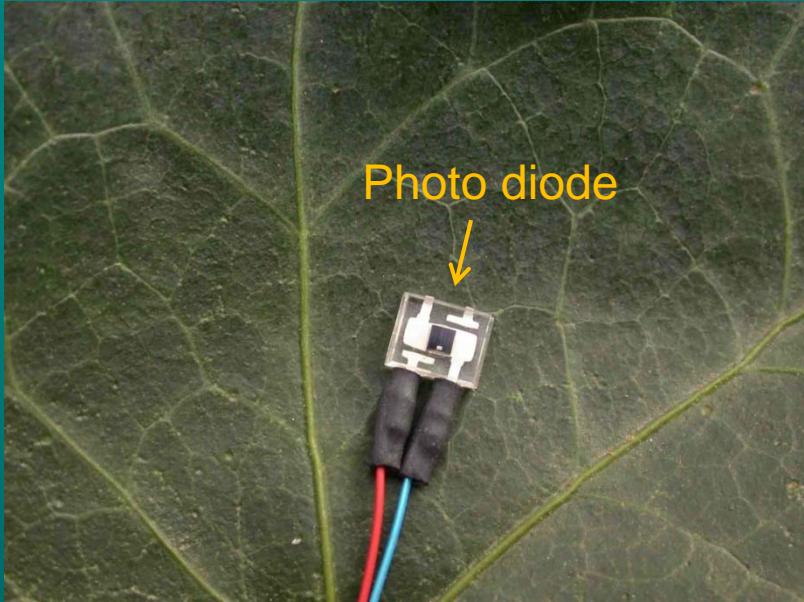
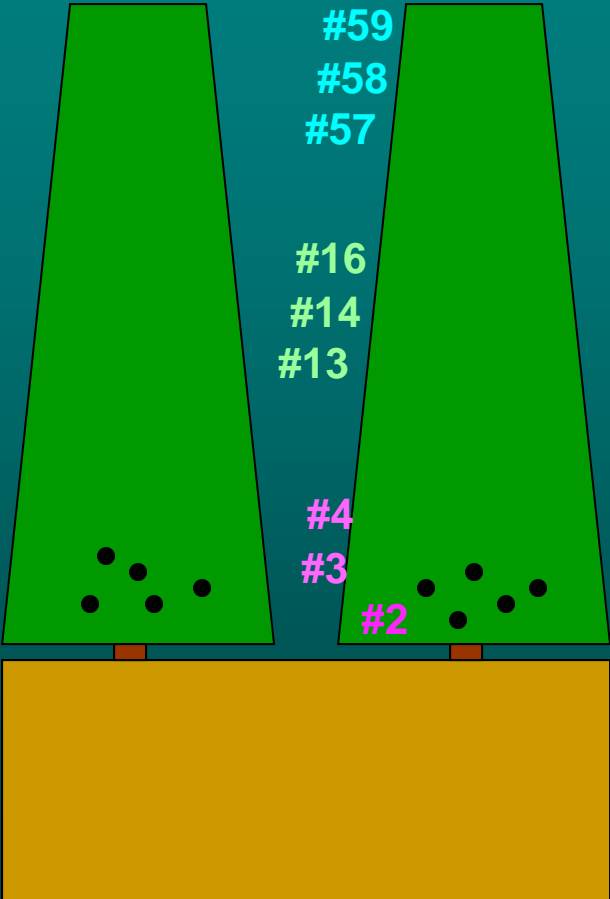
Black pellicle

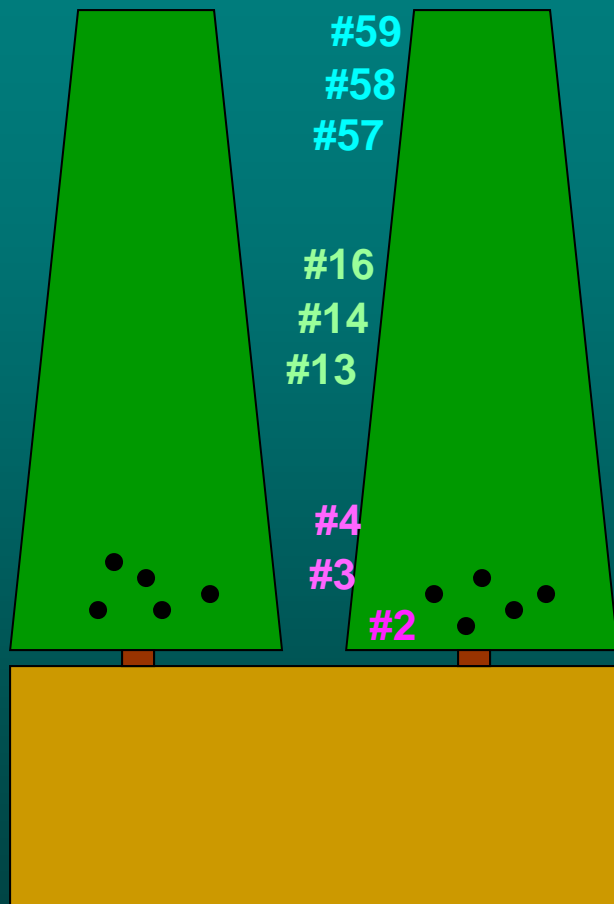


Shrivel



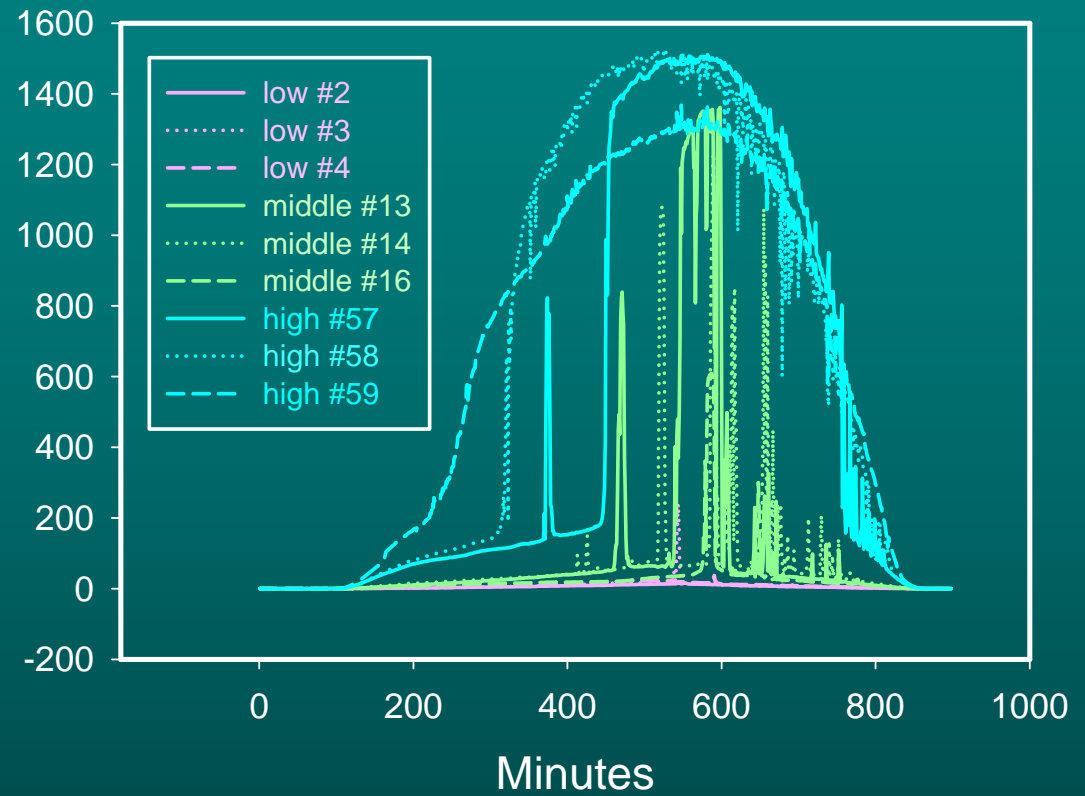
Light sensor attached to leaves throughout canopy





Photosynthetically active radiation ($\mu\text{mol m}^{-2} \text{s}^{-1}$)

Yolo County walnuts 9/23/03



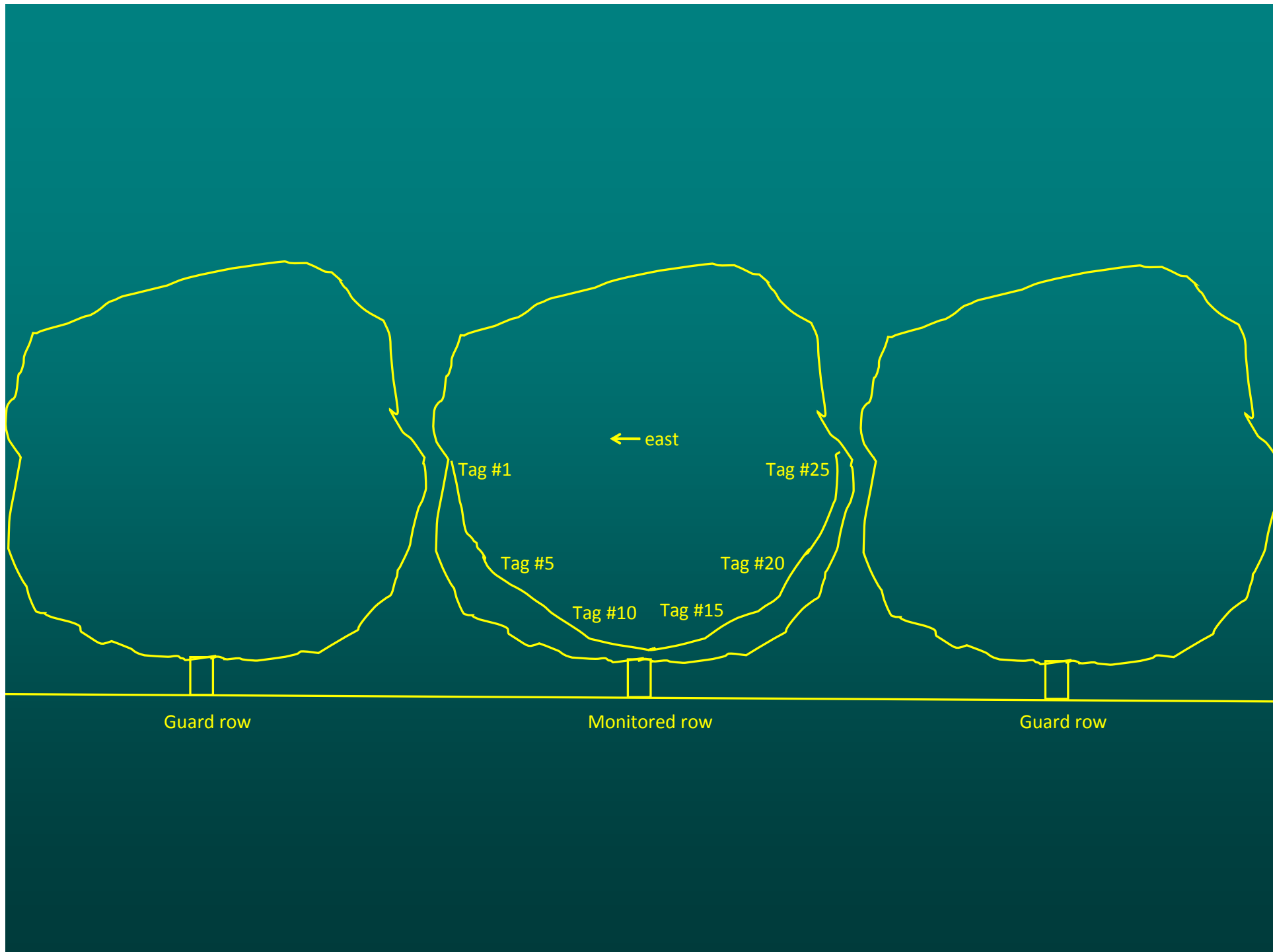
Nuts with quality problems (in this case mostly shrivel and bronze pellicles) came from spurs receiving less than about 30 minutes of direct light per day

Walnut quality studies initiated in 2007 and continued in 2008 and 2009

Replicated in adjacent 9 and 13 year old Chandler orchards

Both orchards have very high percentage of midday canopy light interception

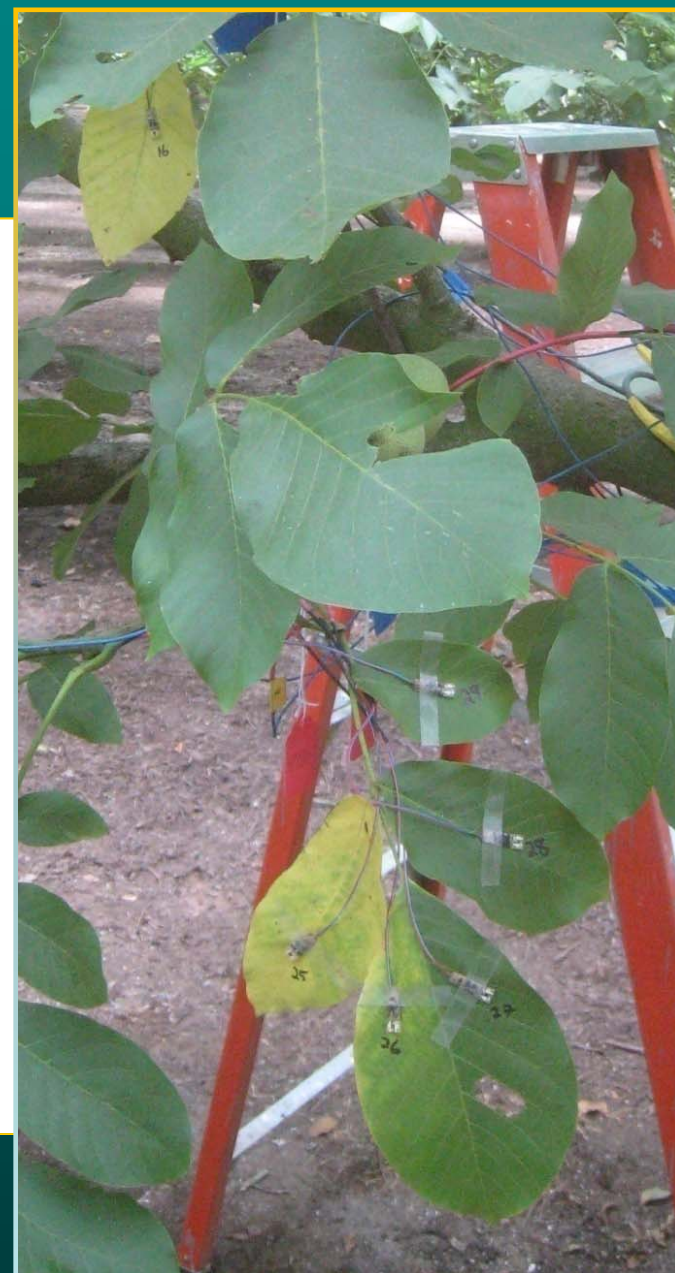
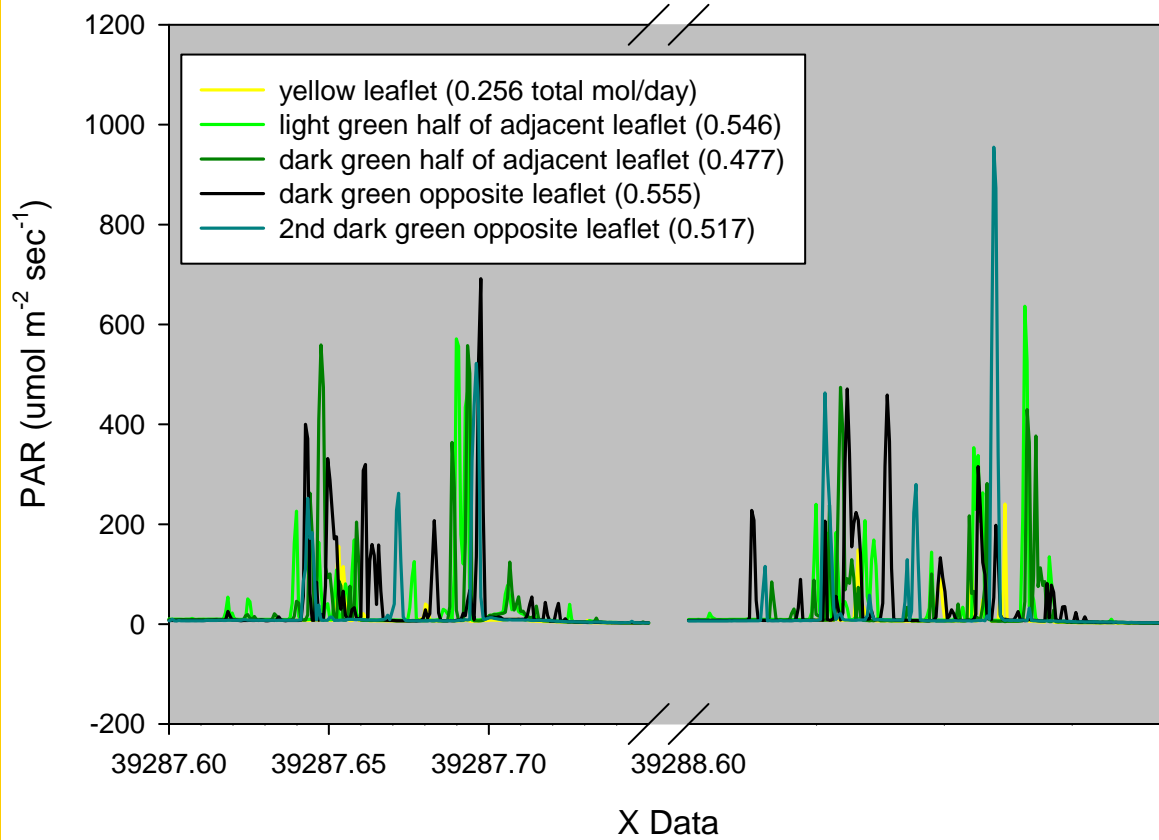
Both orchards have a history of producing nuts with yellow pellicles- according to the grower problem is worst at about 9 years of age and then improves as orchard ages after that

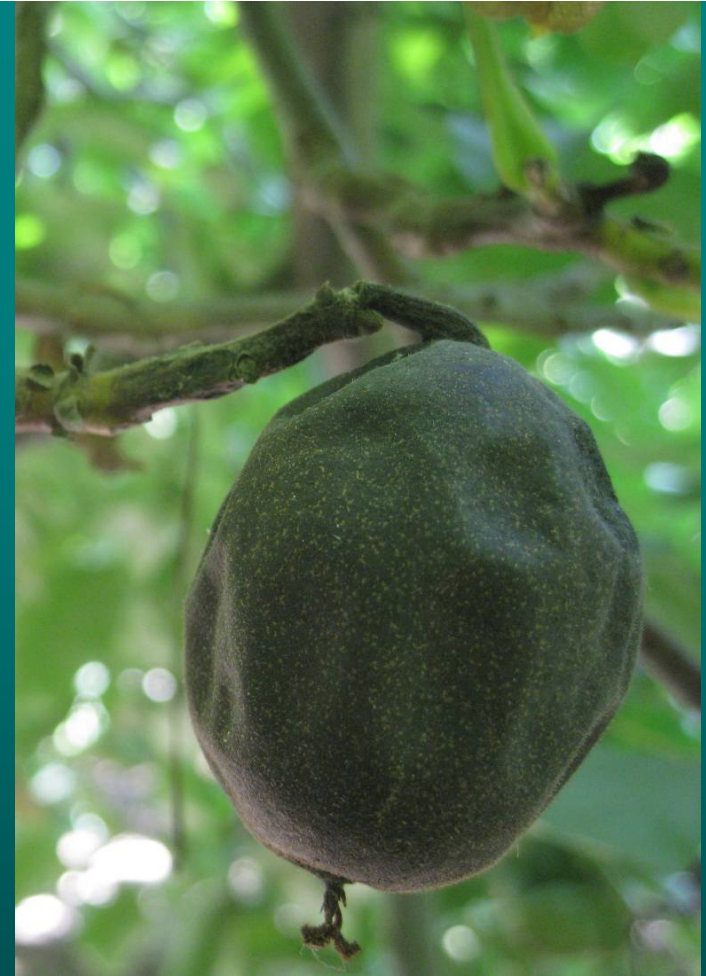


Normal husk split

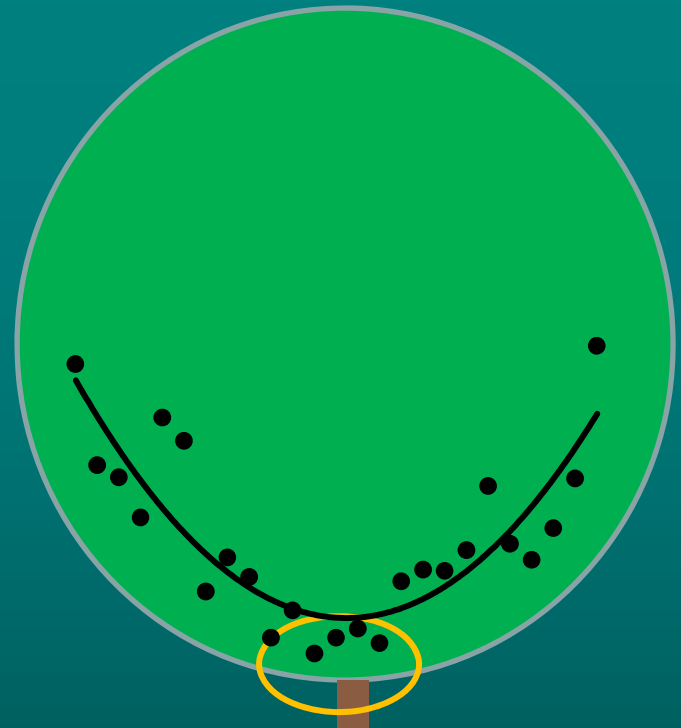
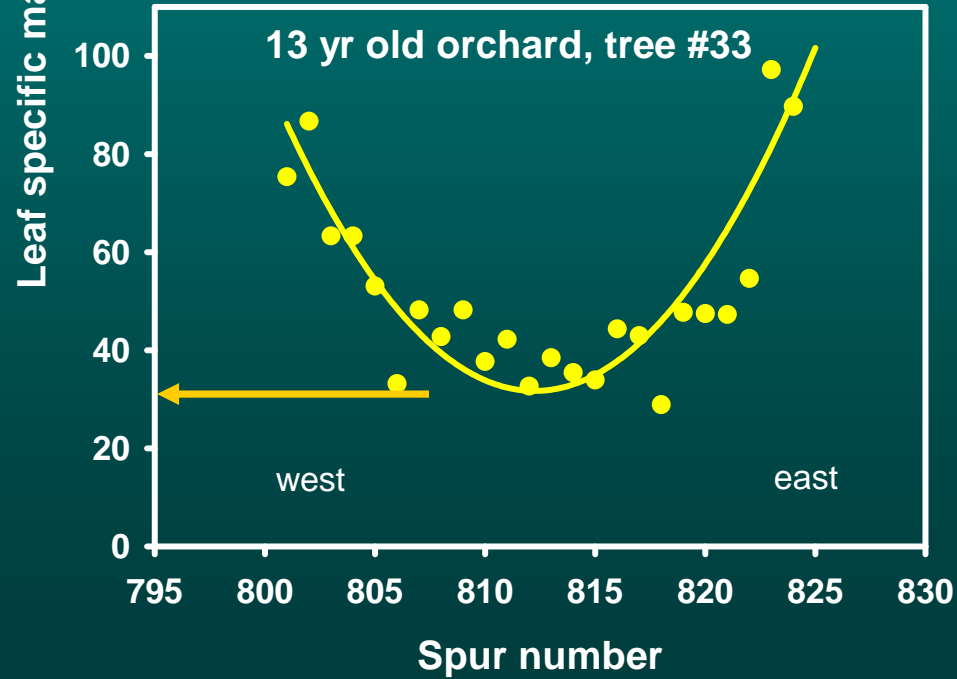
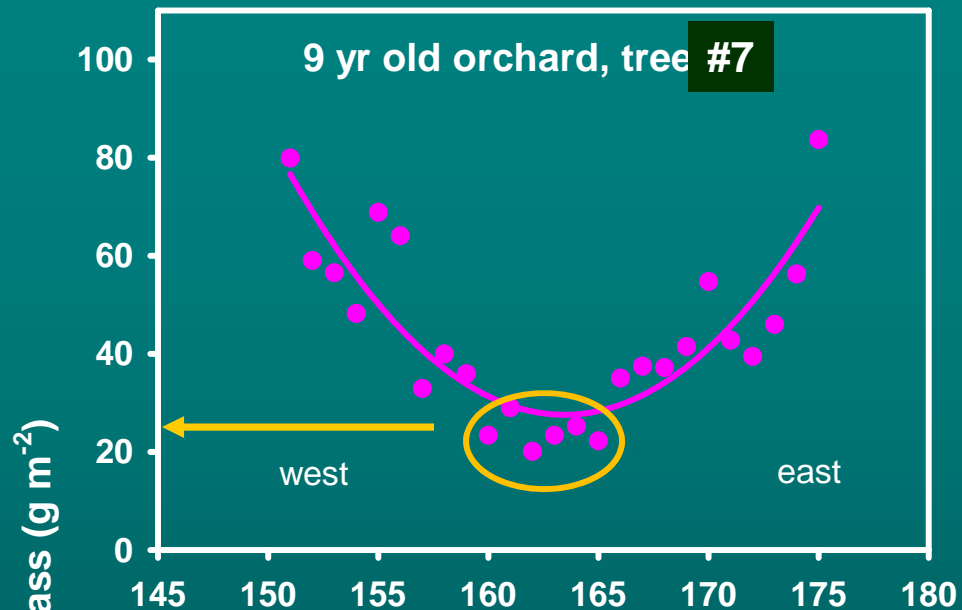


Walnut quality July 25 to 26, 2007



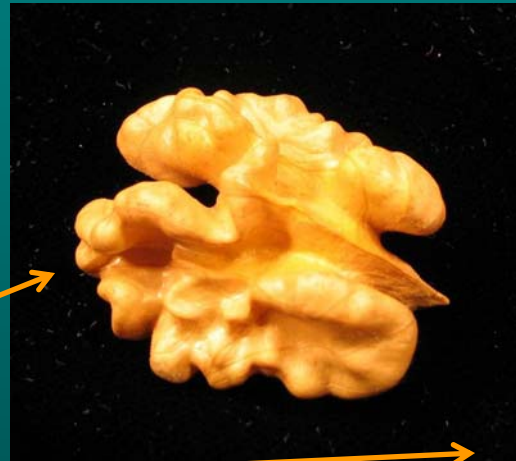


Nuts that sized fully in good light positions and then were shaded tended to lose leaves and the result was well formed nuts with a yellow pellicle (13% of nuts in 2006)- problem was very minor in 2007, 2008 and 2009 (less than 1 percent). In 2011 it was a major problem again.



Most shrivel and pellicle color issues occurred in lower, shaded positions where light levels were lowest

Nuts that have hulls that do not split normally and maintain wet conditions around kernel cause quality problems





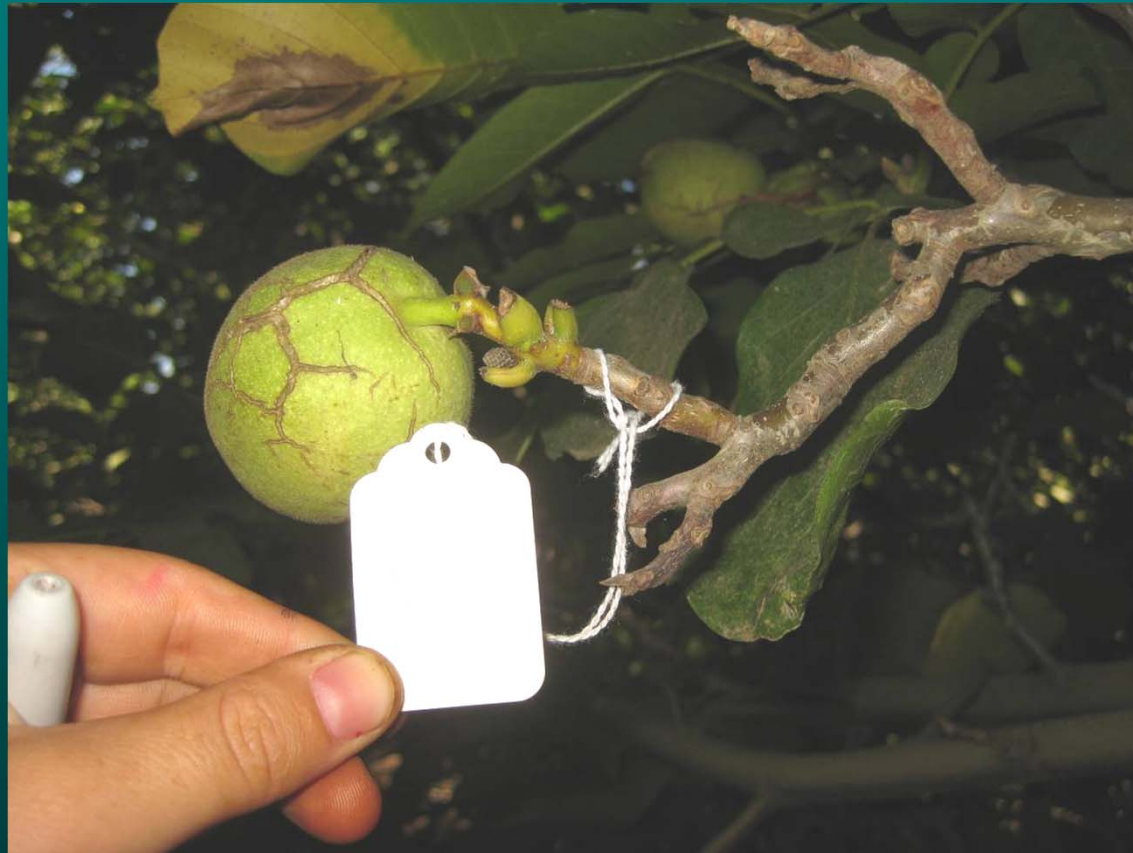
Wet conditions in interior
of nut when hull does not
split normally create
problems



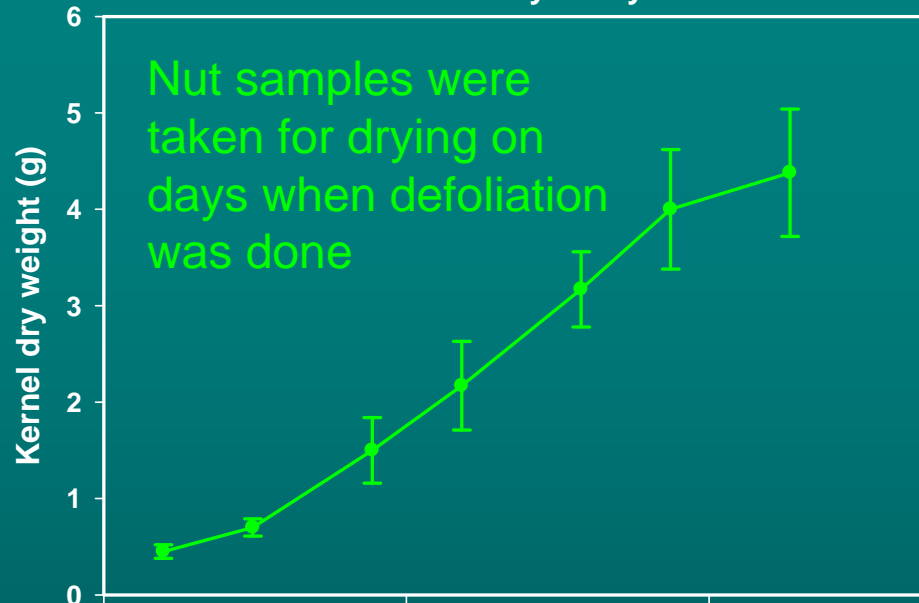
Nickels Soil Lab Howards 9/30/08

2009- artificially defoliated spurs in lower canopy positions at approximately 10 day intervals

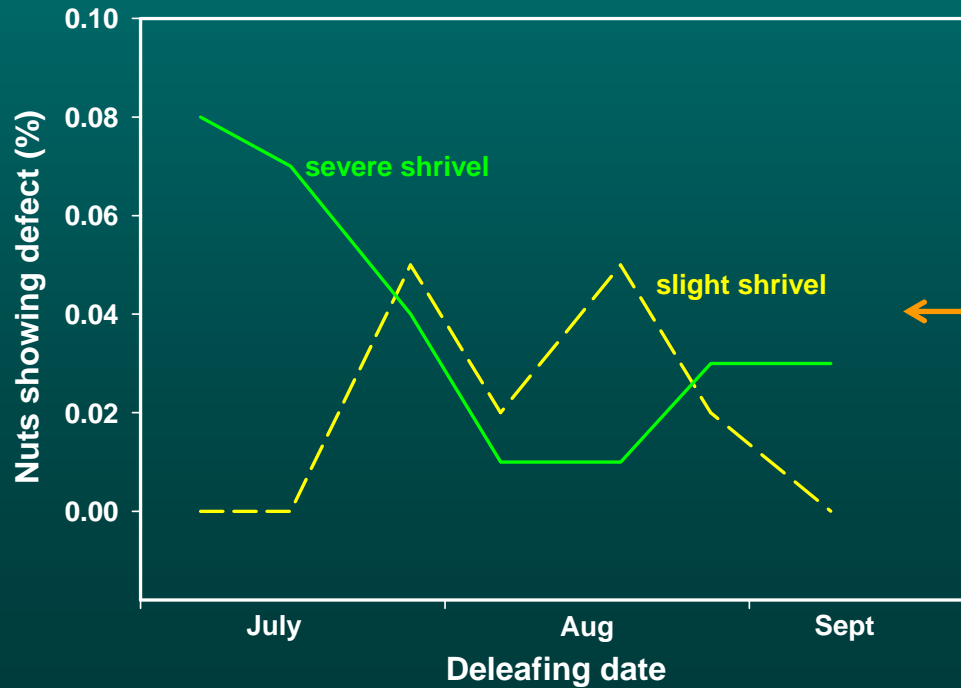
July 7, July 16, July 28, Aug. 6, Aug. 18, Aug. 27 and Sept. 8



Walnut Quality Study 2009

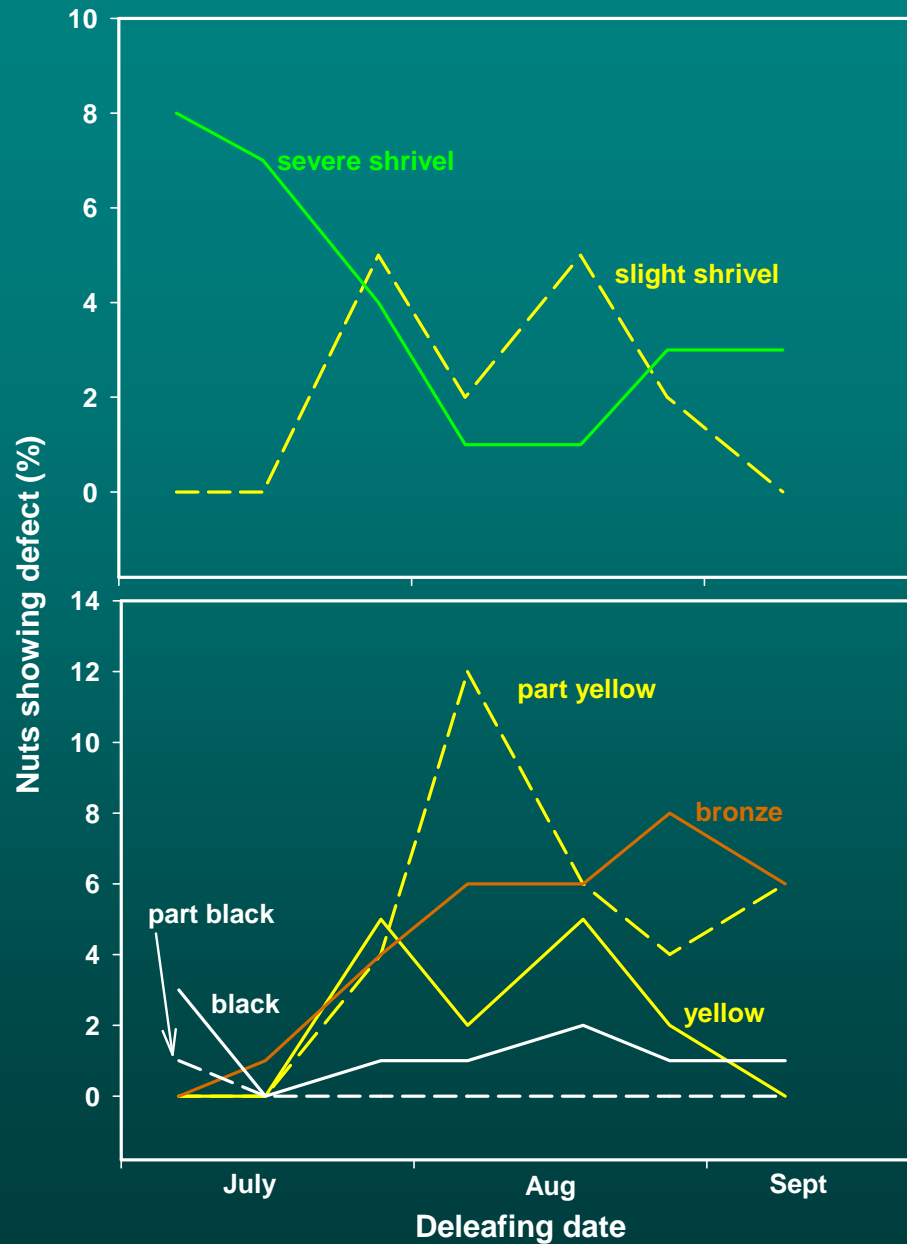


Chandler in San Joaquin County

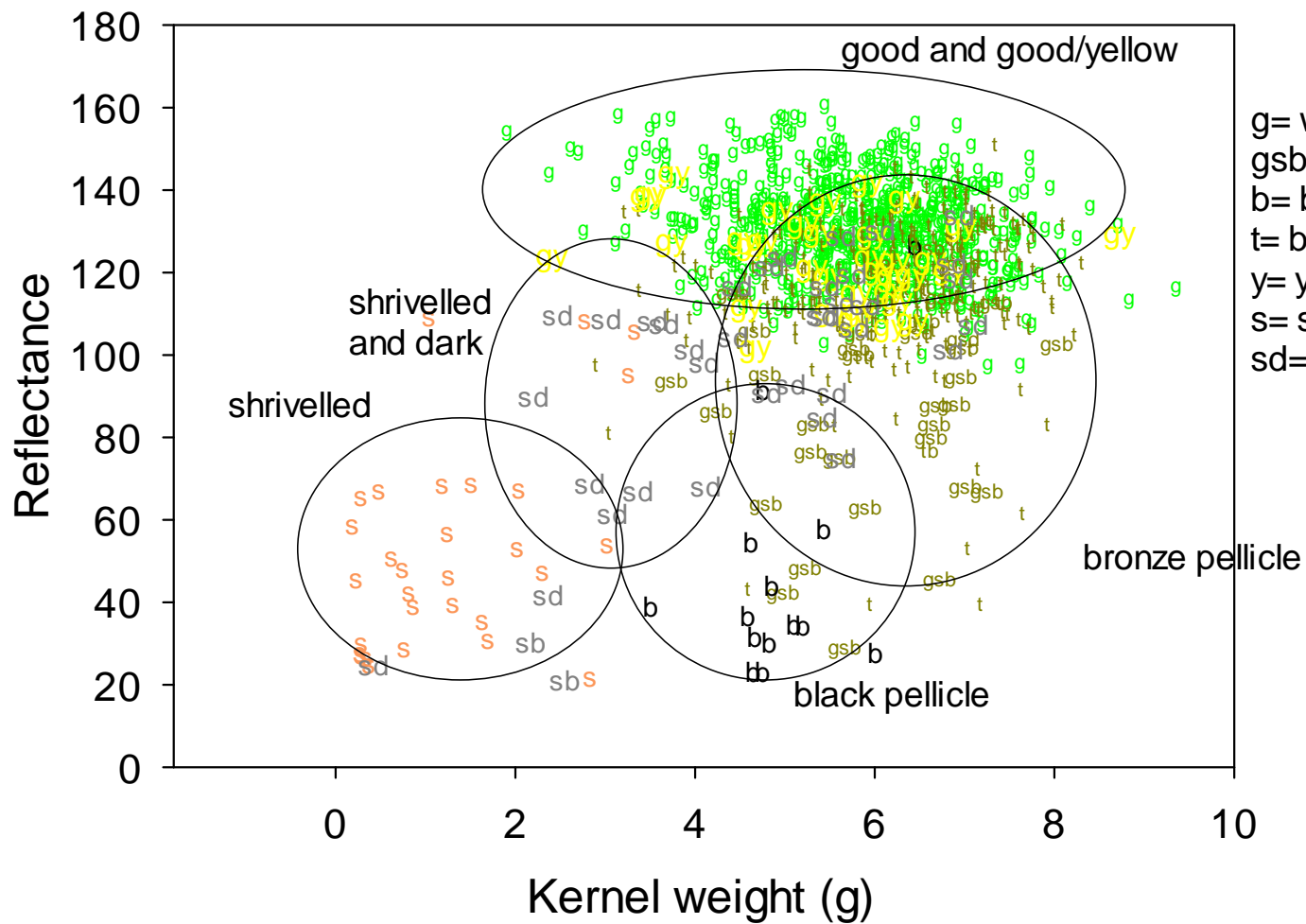


Stress during July through early September can influence shelling percentage

Chandler in San Joaquin County



<u>Condition</u>	<u>Peak</u>
Thin shell	early June
Severe shrivel	early July
Slight shrivel	early Aug
Yellow pellicle	early Aug
Black pellicle	mid- Aug
Bronze pellicle	late Aug/early Sept.

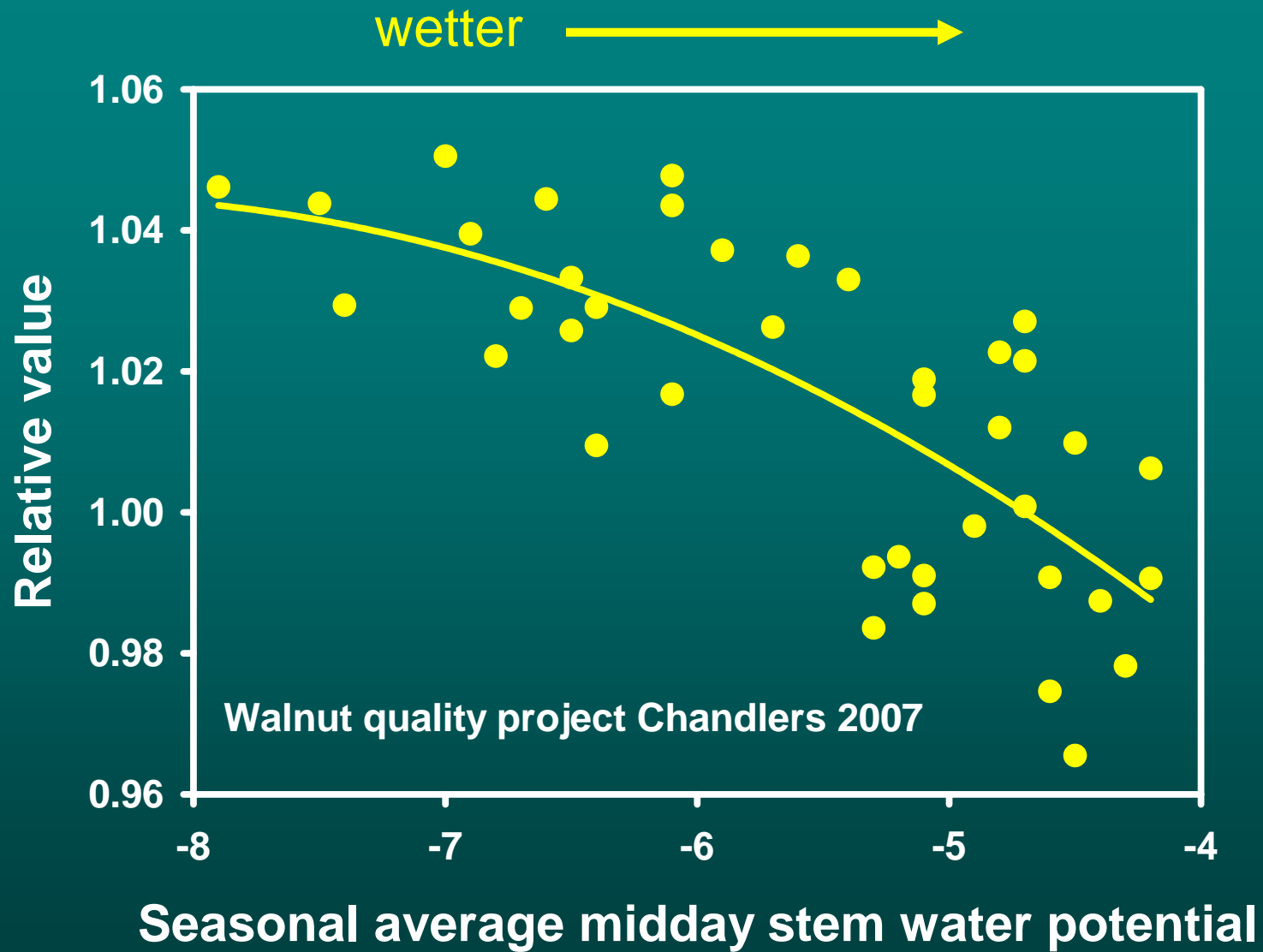


g= well filled nut with light pellicle
 gsb= some bronzing of pellicle
 b= black pellicle
 t= bronze pellicle
 y= yellow pellicle
 s= shriveled
 sd= shriveled and dark

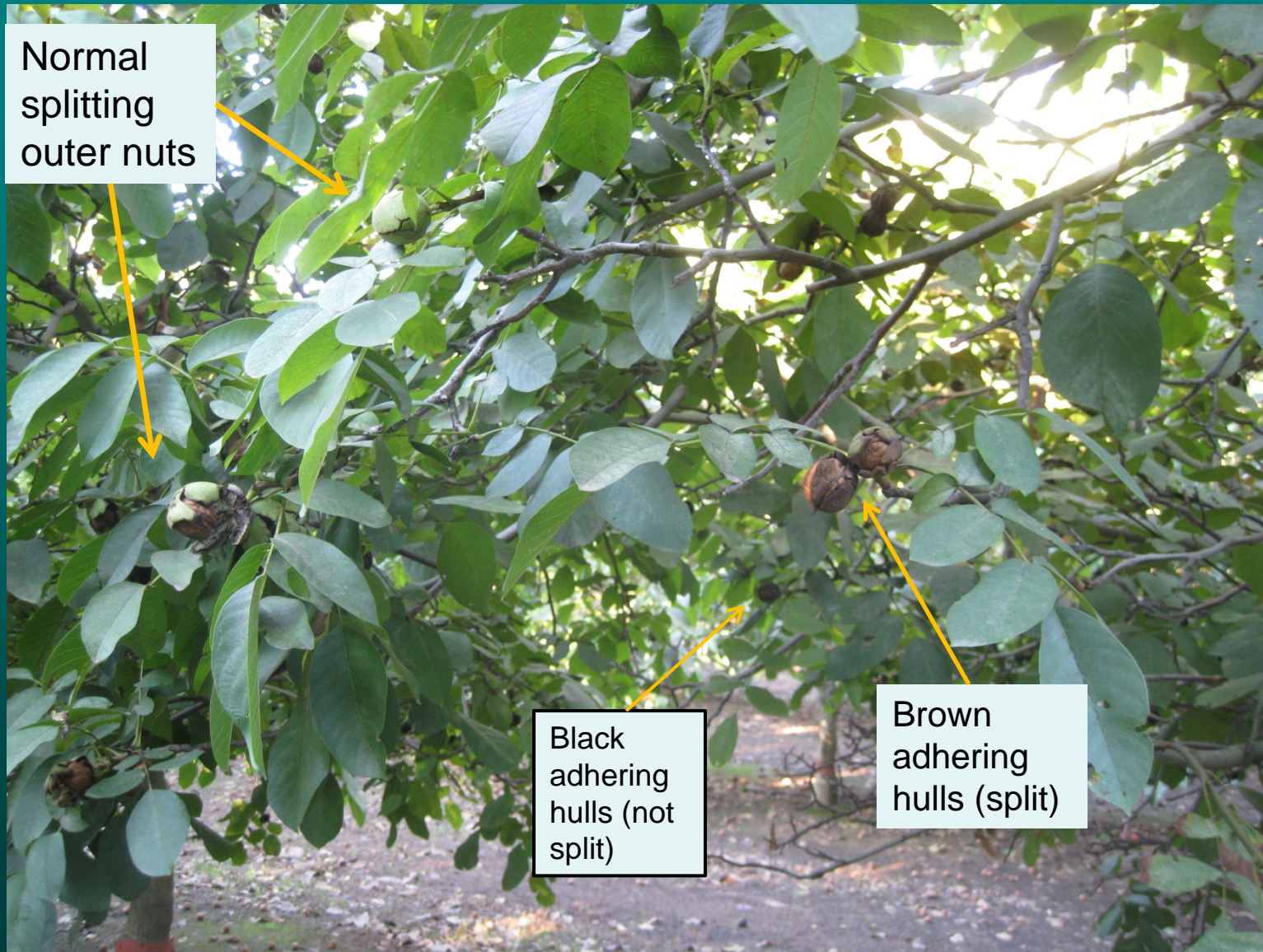
Bronze pellicled nuts
 are likely what are
 commonly called
 oilless nuts

- Factors that can effect walnut quality

- Variety- Chandler is generally lightest (partly because of late harvest and cooler conditions at that time)
- Leaf loss
 - Due to shading in lower canopy
 - Due to disease/insect pressure
 - Due to water stress
- Insect damage to hull (husk fly)
- Water stress
- Harvesting nuts with green hulls and not removing hulls immediately
- Hot conditions during harvest
- Nuts being wetted on orchard floor by irrigation or rainfall

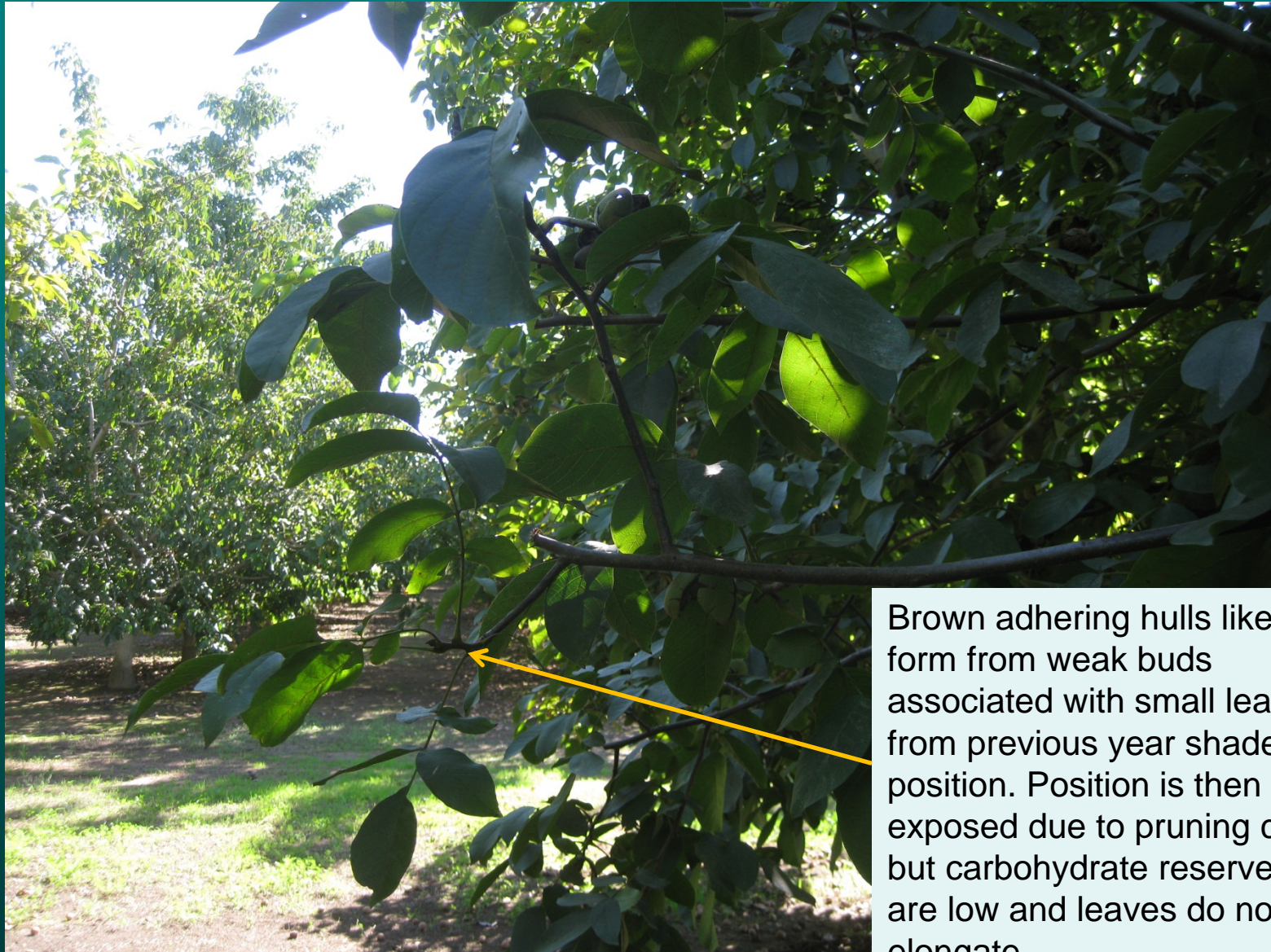


Normal
splitting
outer nuts



Black
adhering
hulls (not
split)

Brown
adhering
hulls (split)



Brown adhering hulls likely form from weak buds associated with small leaves from previous year shaded position. Position is then exposed due to pruning cut but carbohydrate reserves are low and leaves do not elongate.



Both in full light positions



Outer exposed nut- normal split



Brown adhering hull- split



Black adhering hull- no split



Pee wee nuts

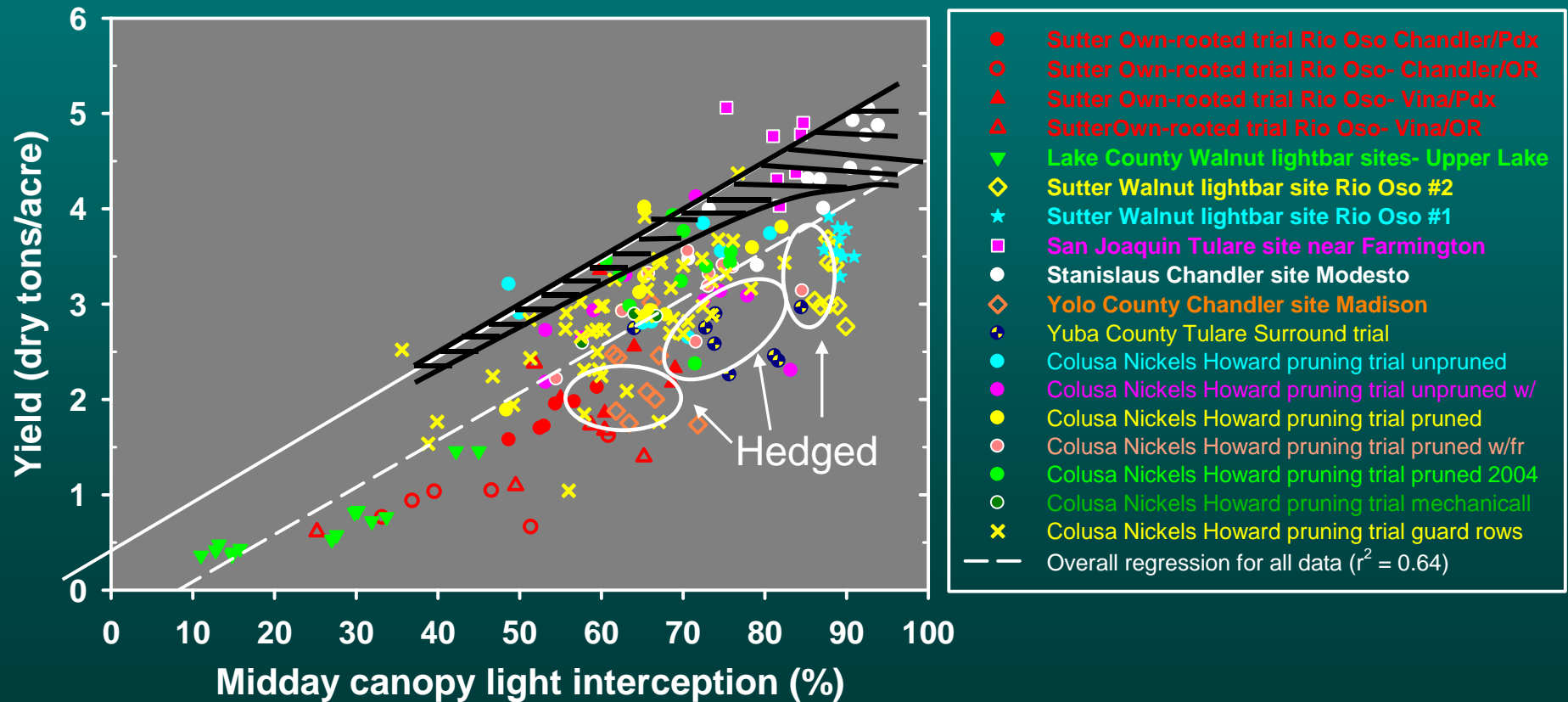


Pee wee nuts

Pee wee nuts in Nickels Howard hedging trial 2012

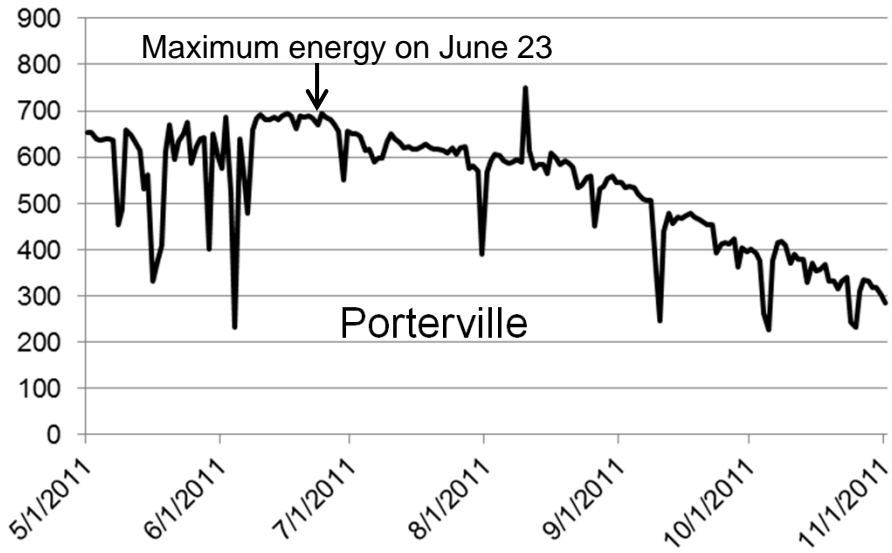
- Not related to current year conditions (i.e. not from late bloom)
- Small number and little expansion of leaves even if in good light position in current year
- Likely due to limited carbohydrate storage in bud from previous season
- Likely from buds that formed in low light position the previous year
- If these positions are then exposed due to hedging or pruning they grow and produce small nuts

- If your orchard is approaching its yield potential, some quality problems are likely to occur in lower canopy due to shading related issues
- Quality problems can be greatly exacerbated by short term stress events

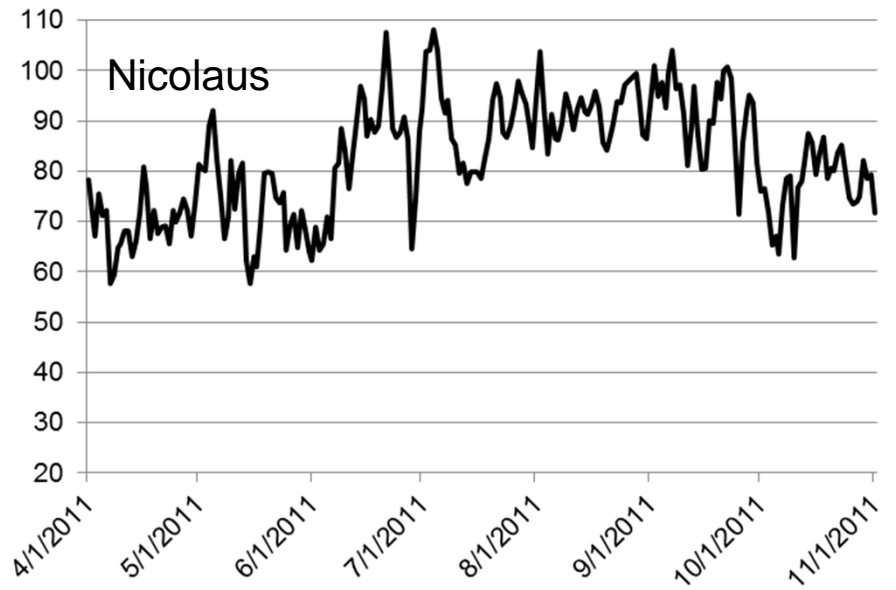
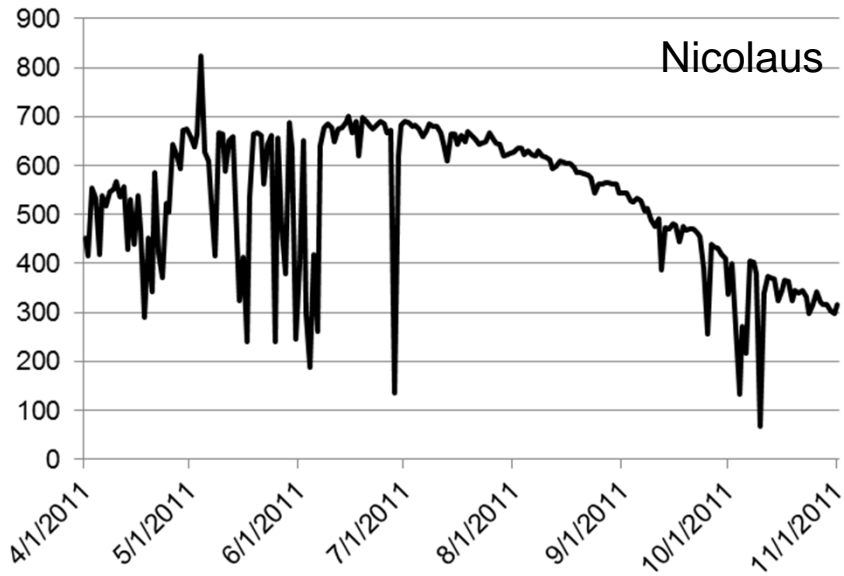
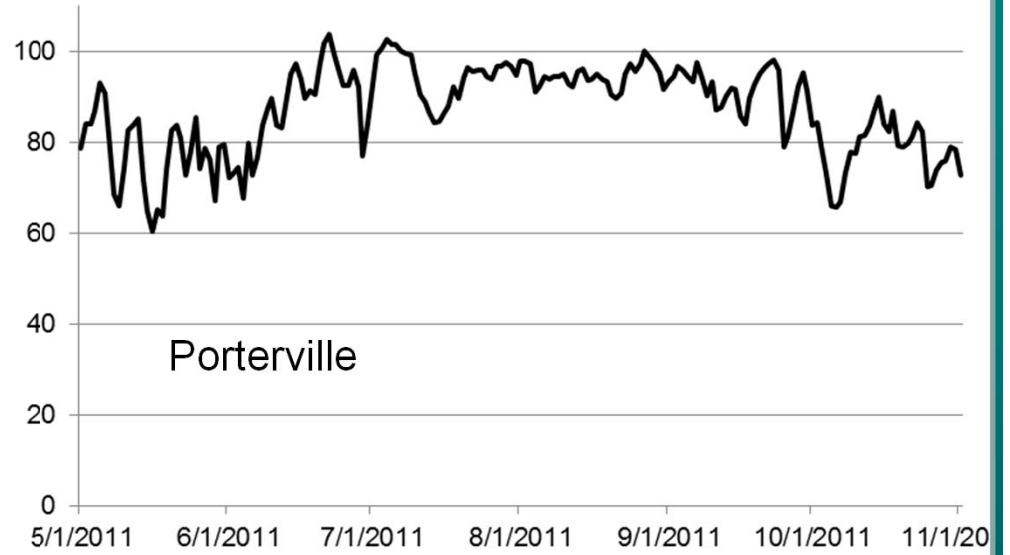


What conditions in 2011 could have contributed to quality problems?

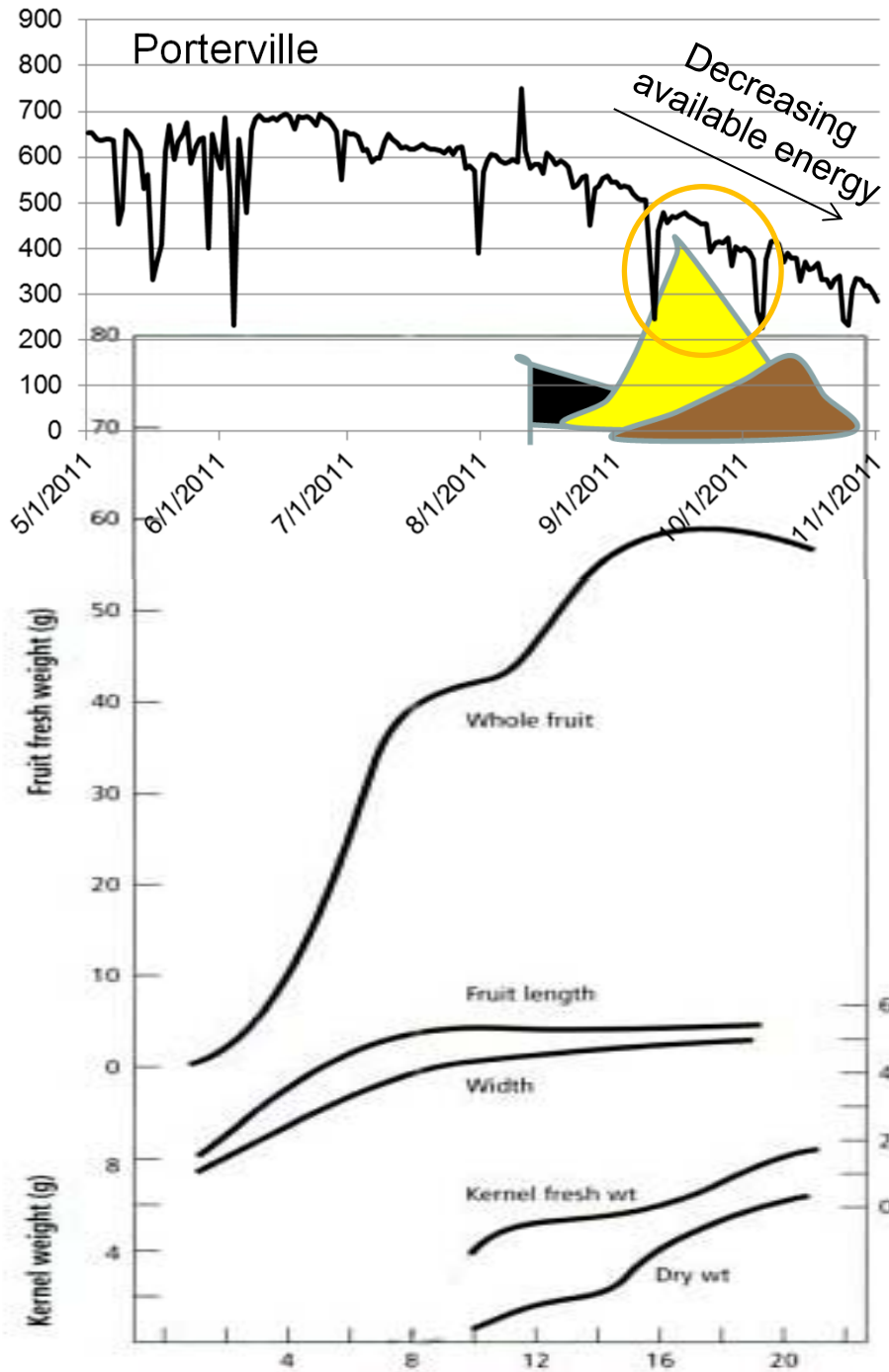
Sol Rad (Ly/day)



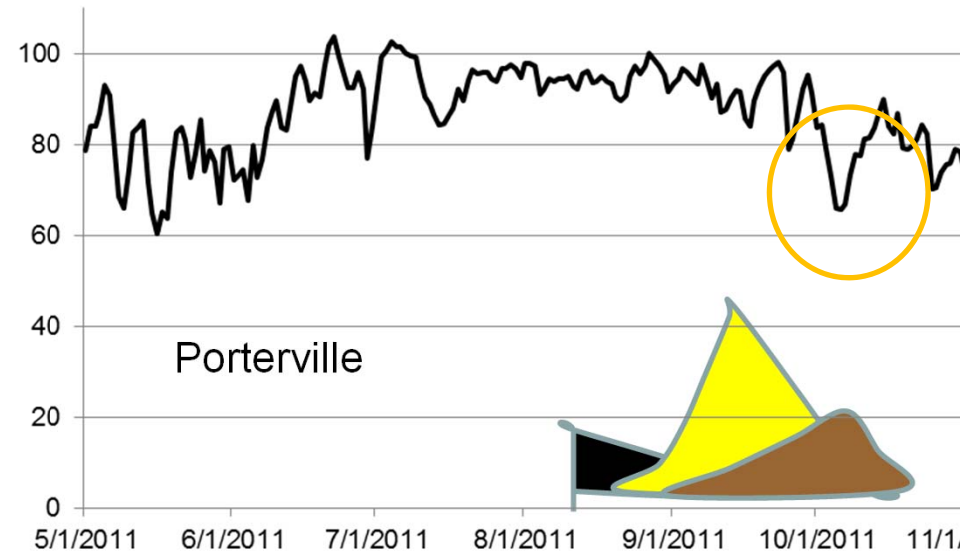
Max Air Temp (°F)



SoI Rad (Ly/day)



Max Air Temp (°F)



Energy available on October 1 is only 80% that available on September 1

Summary of nut quality problems for Chandler in San Joaquin County as related to period of carbohydrate deprivation

Condition	Carbohydrate deprivation period
Thin shell	early June
Severe shrivel	early July
Slight shrivel	early Aug
Yellow pellicle	early Aug
Black pellicle	mid- Aug
Bronze pellicle	late Aug/early Sept.

In order to keep lower canopy positions alive and productive, at least ½ hour of direct sunlight is required. As orchard gets above about 70% midday canopy light interception (or yields above 3 tons/ac), these lower positions will be continually shading out due to lack of light and this results in quality problems.



Thin shell-
likely due to
carbohydrate
deprivation
during
May/June due
to prolonged
cloudy periods

Yellow
pellicle- likely
due to
carbohydrate
deprivation
during early
August (leaf
loss, shading
or water
stress)



Surprise?



Questions?