

Orchard Management Impacts on Quality in Walnut

Bruce Lampinen

Integrated Orchard Management Specialist

UC Davis/UCANR



Thin shell



Yellow pellicle



Bronze pellicle



Shrivel



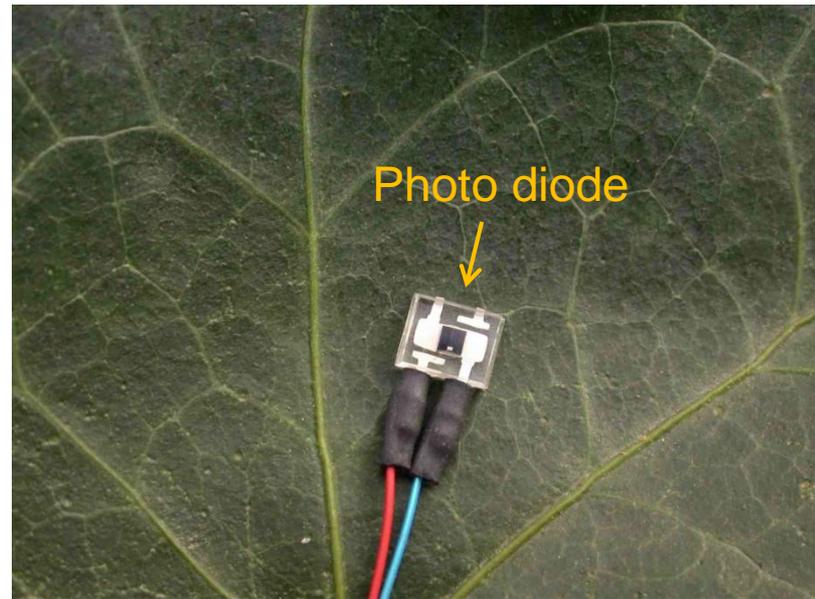
Black pellicle



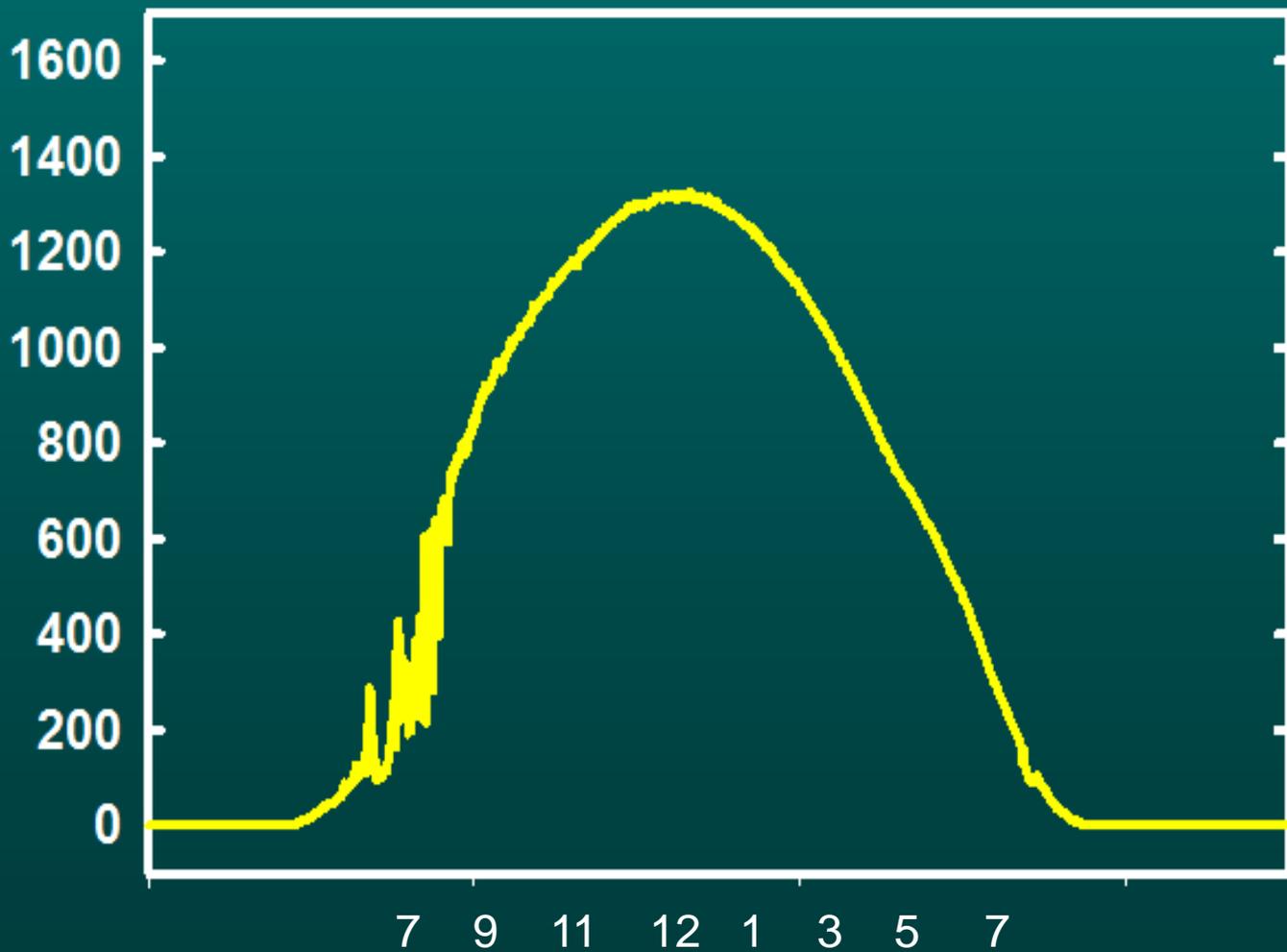
In 2003, saw large number of nuts with black, mushy hulls in a Tulare hedgerow orchard in Solano County

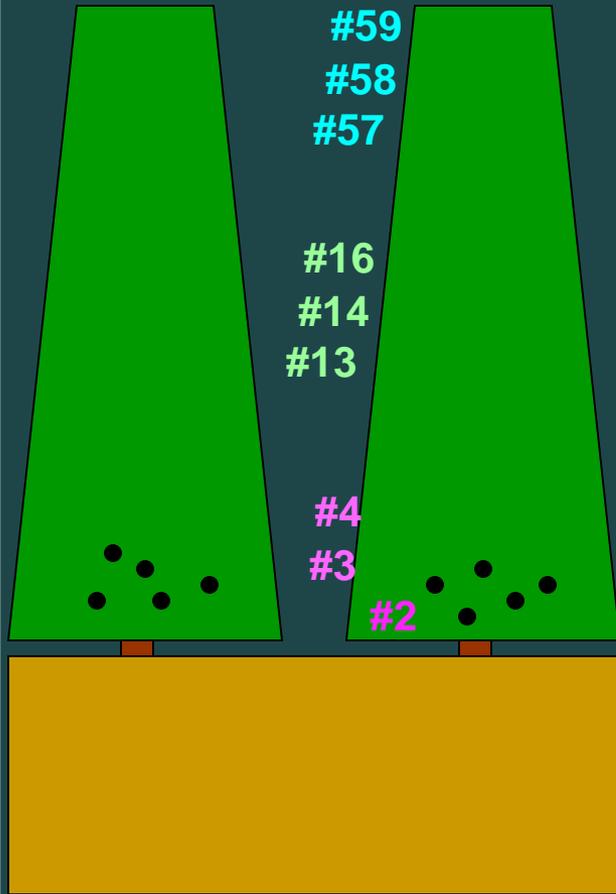


Light sensors attached to leaves throughout canopy



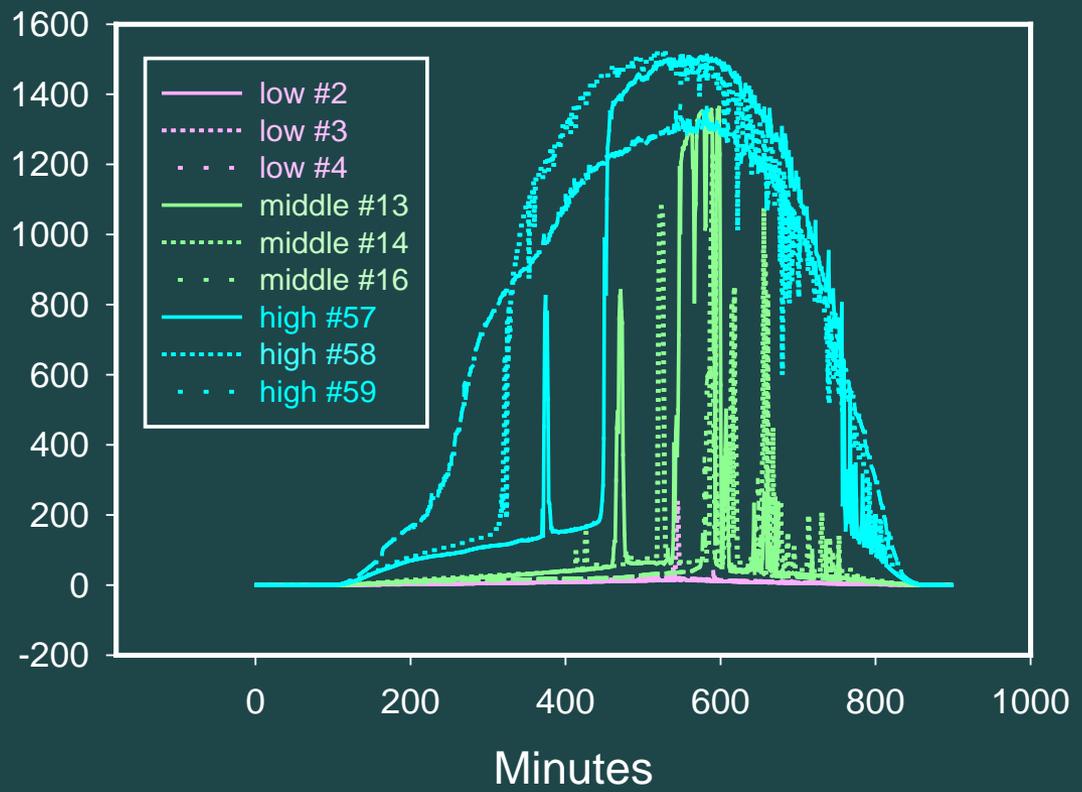
Photosynthetically
active radiation
($\mu\text{mol m}^{-2} \text{sec}^{-1}$)





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

Yolo County walnuts 9/23/03

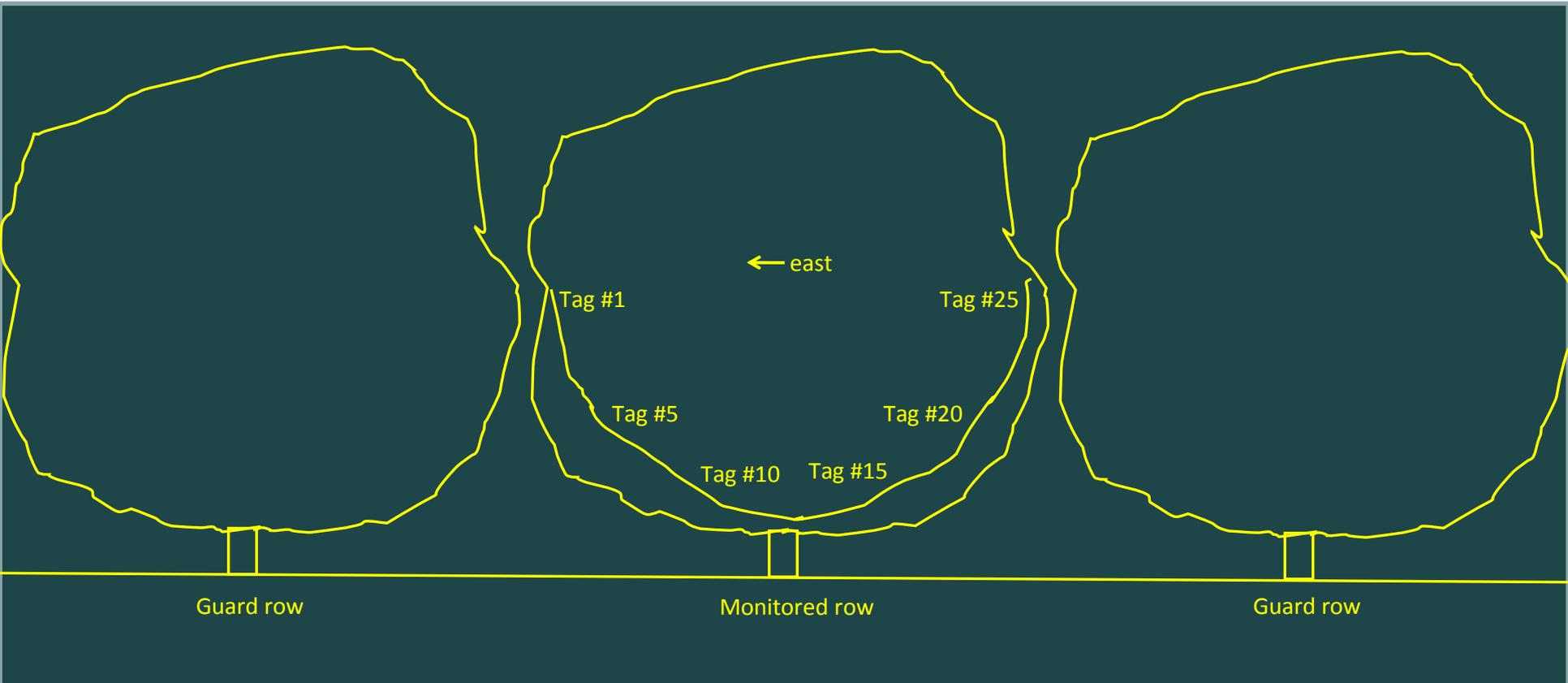


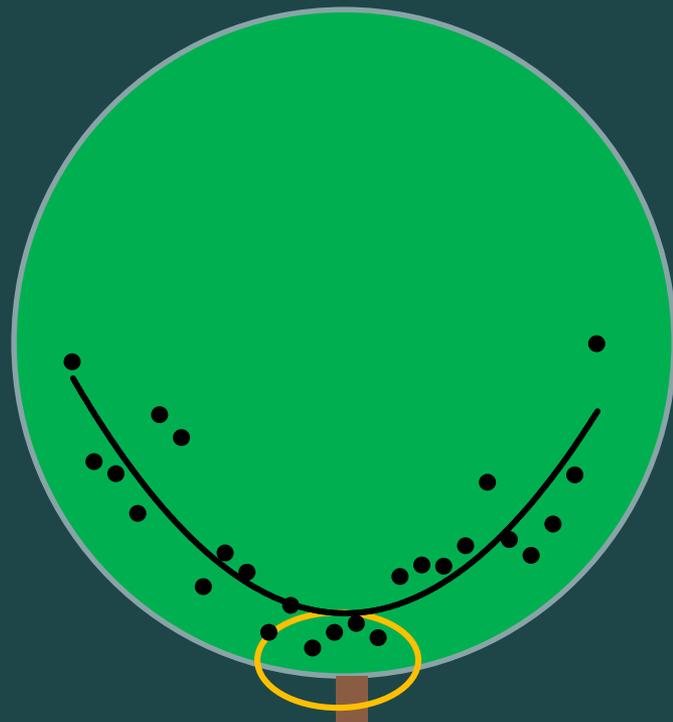
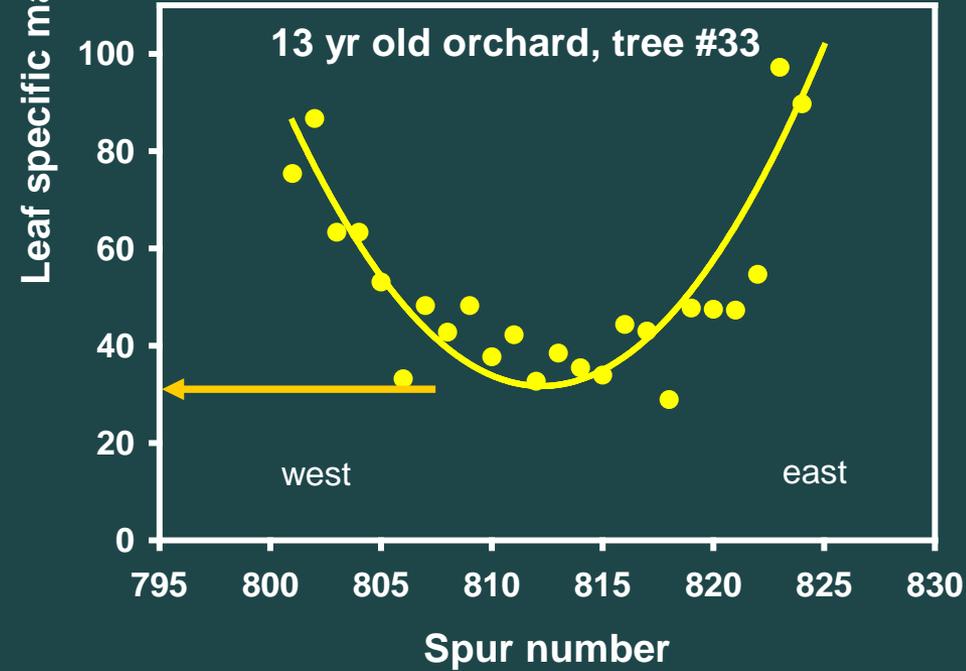
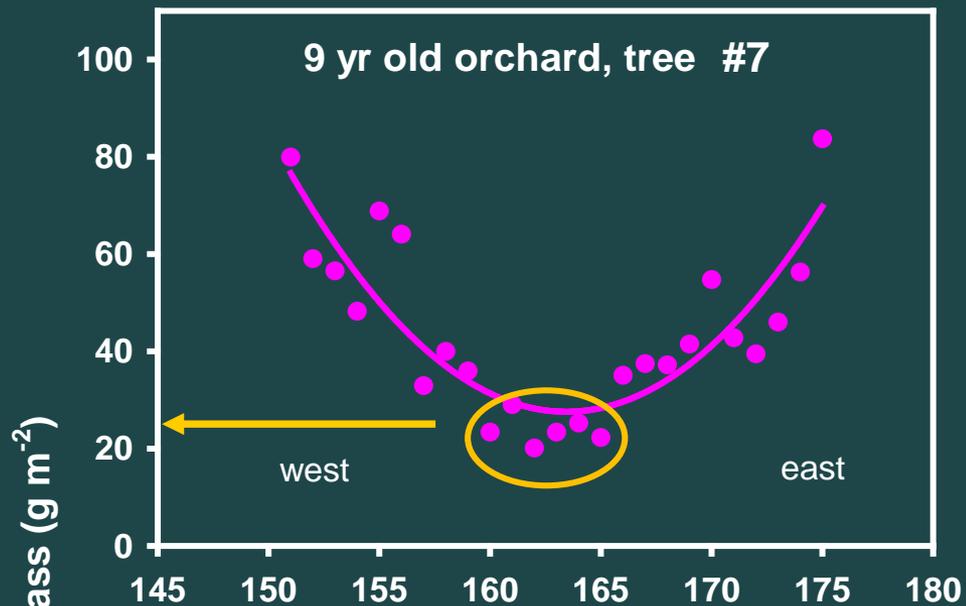
Nuts with quality problems (in this case mostly shrivel and bronze pellicles) came from spurs receiving less than about 30 minutes of direct light per day

Walnut Quality Study - San Joaquin County

- 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

Positions of tags

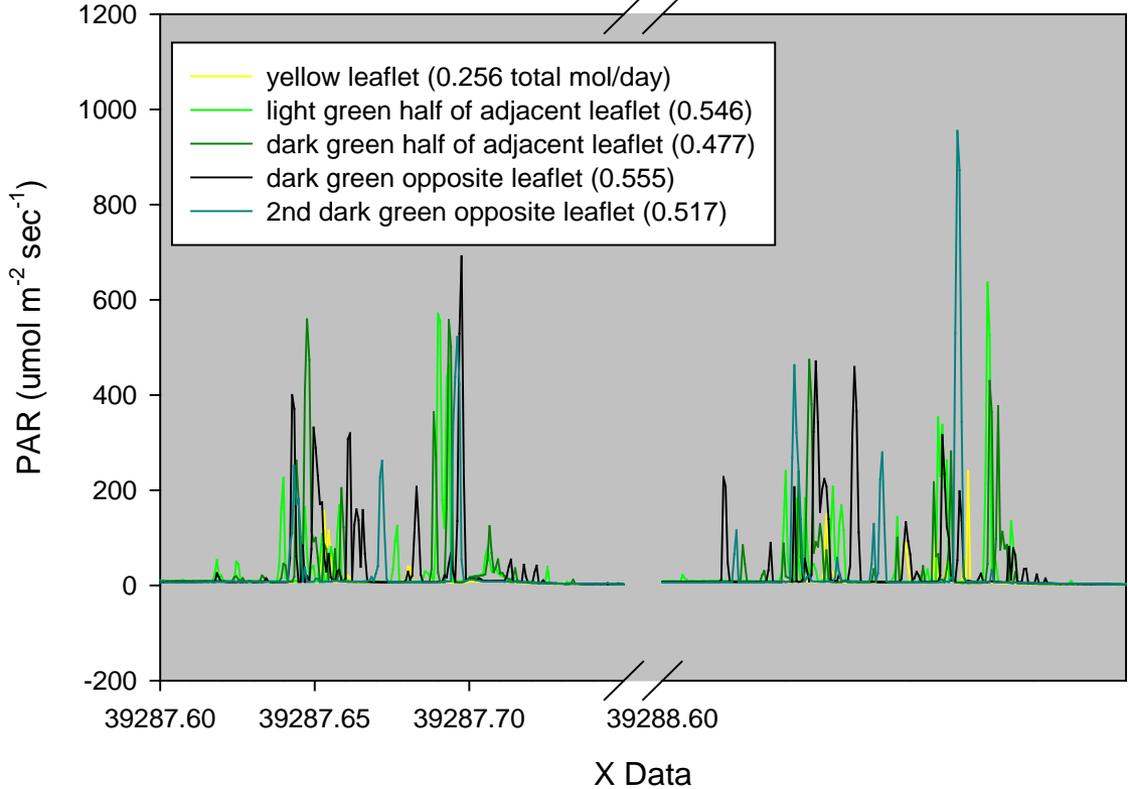




Most shrivel and pellicle color issues occurred in lower, shaded positions where light levels were lowest

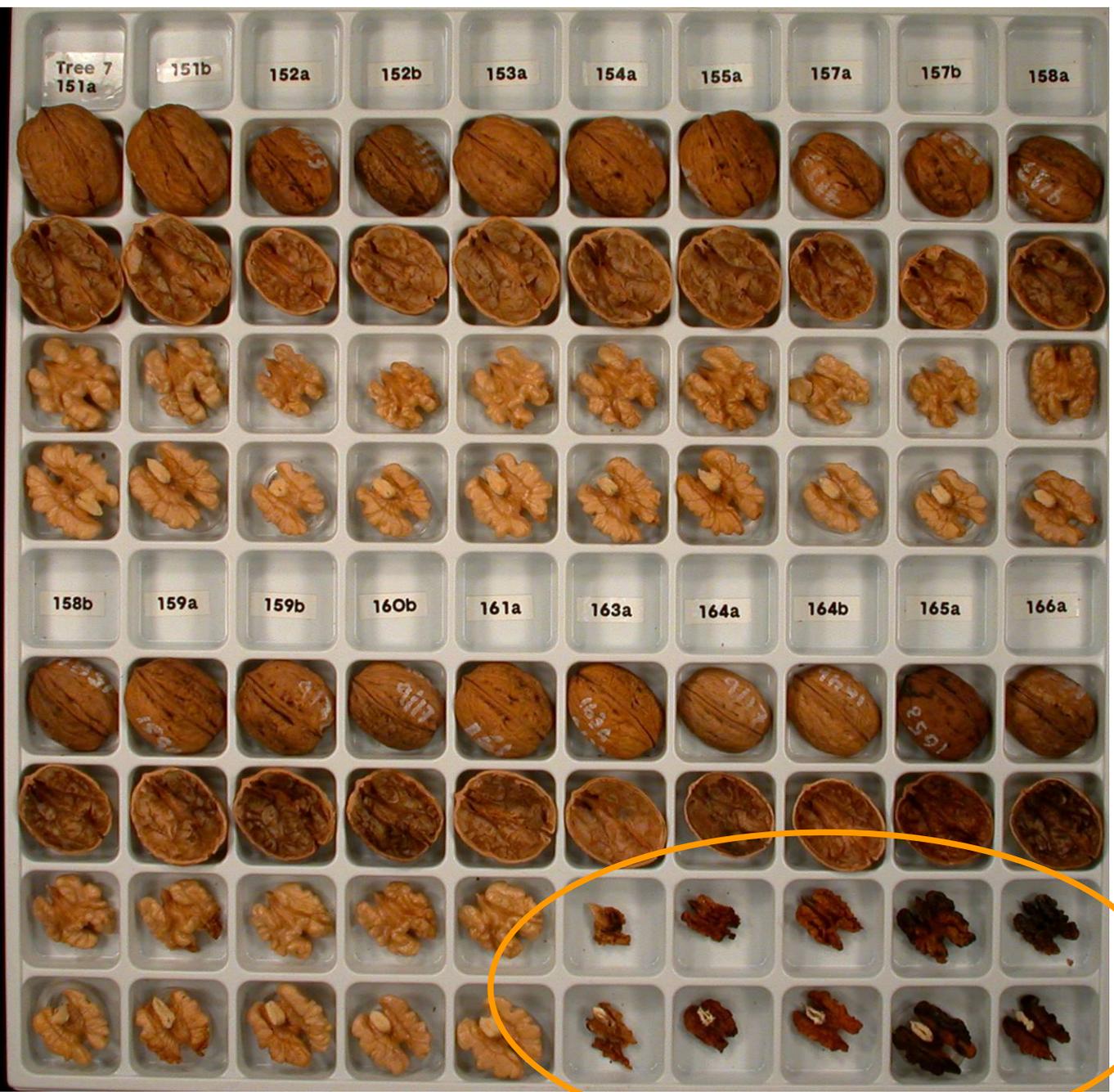
Yellow leaflet received half the light compared to dark green leaflets

Barton quality July 25 to 26, 2007

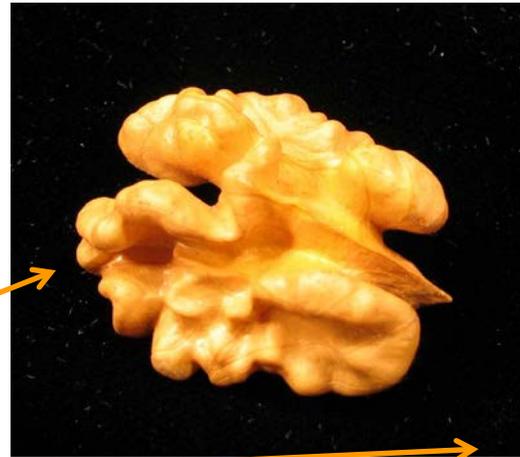


Nuts were numbered with paint markers on the tree after they split and then collected on ground at regular intervals





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









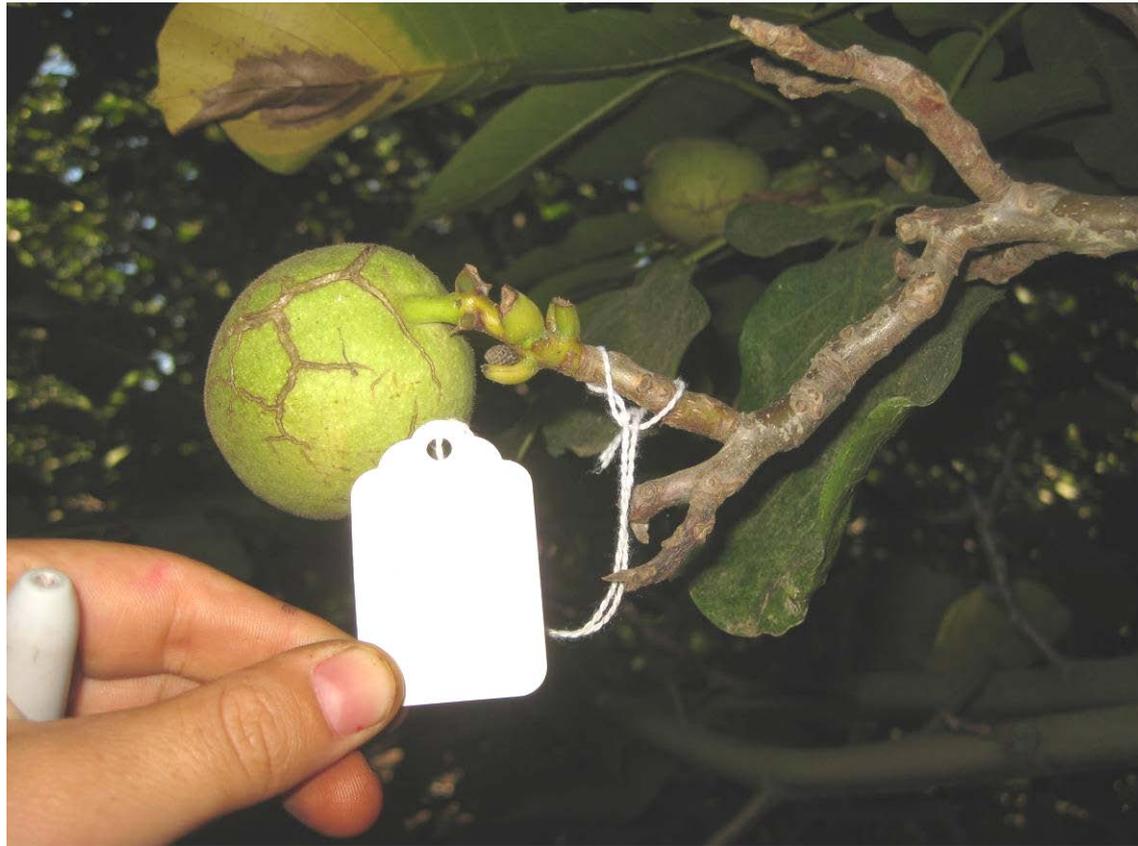
Wet conditions in interior
of nut when hull does not
split normally create
problems



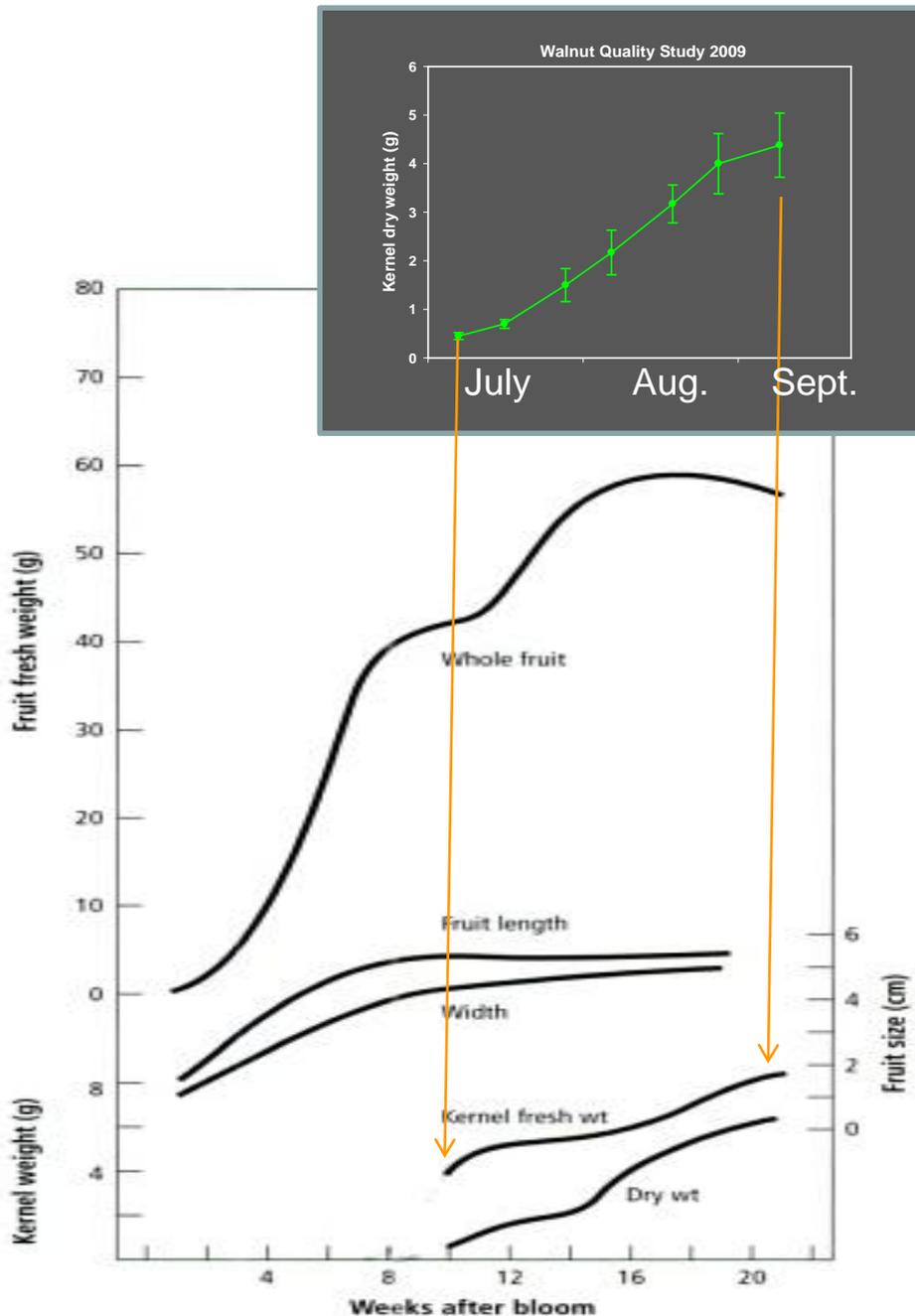
Nickels Soil Lab Howards 9/30/08

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



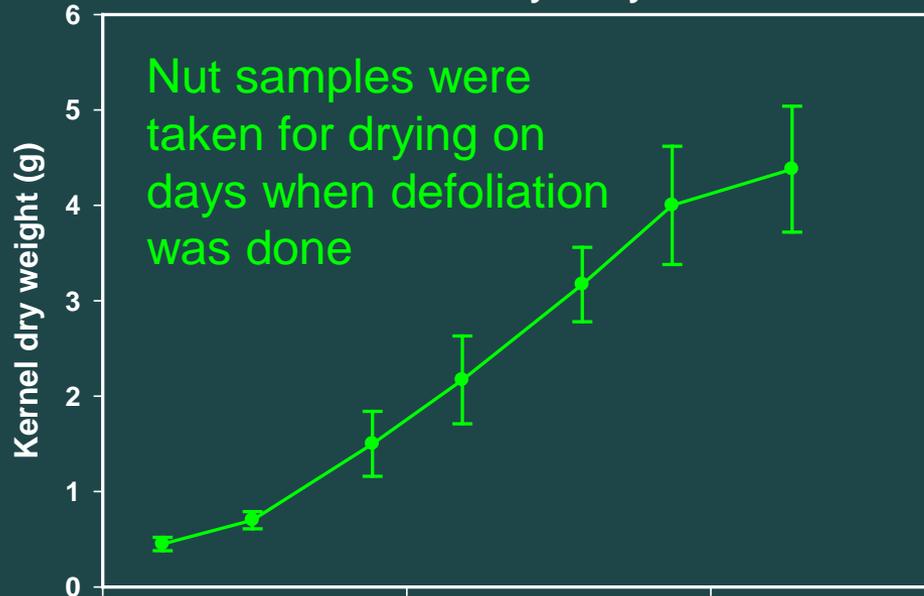
Chandler in San Joaquin County



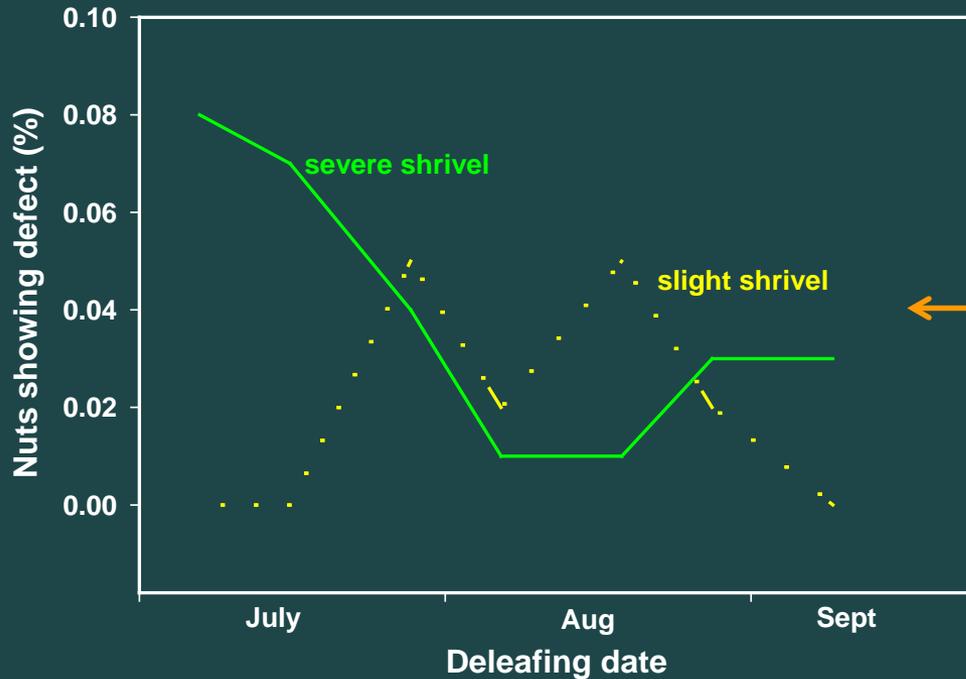
← Nuts had achieved their full length by the time de-leafing treatments were imposed

Figure 18.3 Growth of the walnut fruit and kernel as a function of

Walnut Quality Study 2009

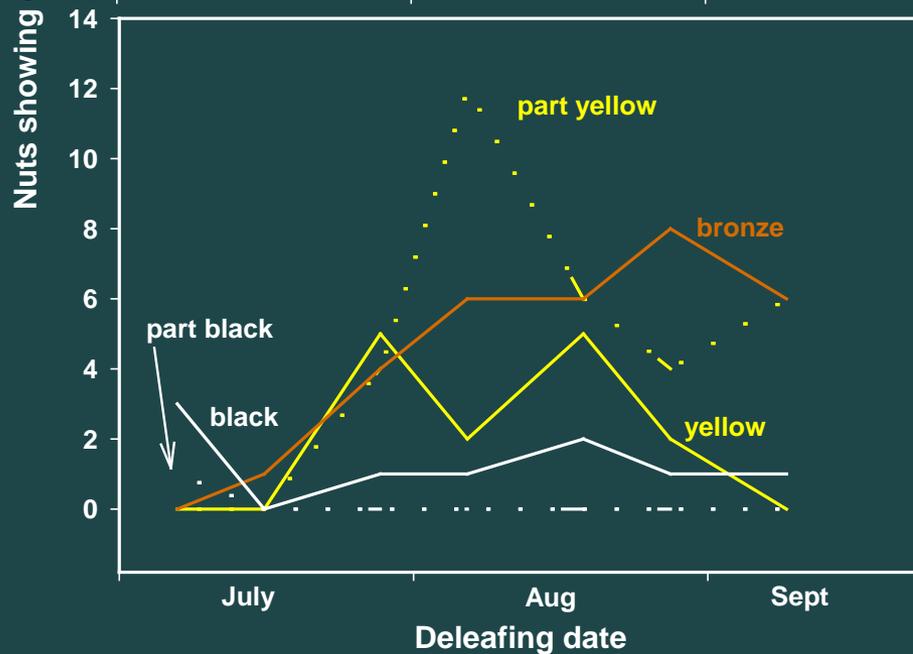
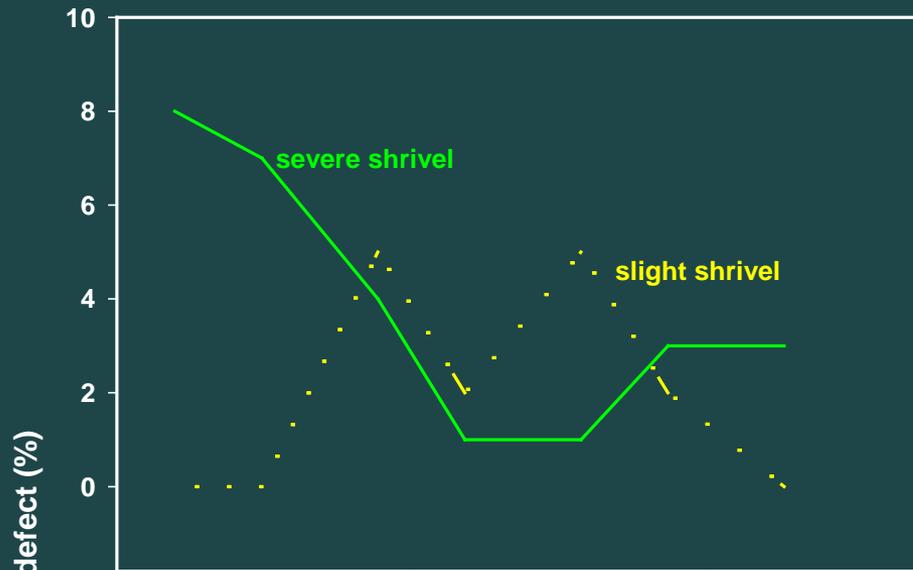


Chandler in San Joaquin County



Stress during July through early September can influence shelling percentage

Chandler in San Joaquin County



Condition

Peak

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



These pellicle color problems result from the wet conditions around the kernel and these same conditions can occur if the nuts fall onto set soil and sit for some time surrounded by wet conditions.

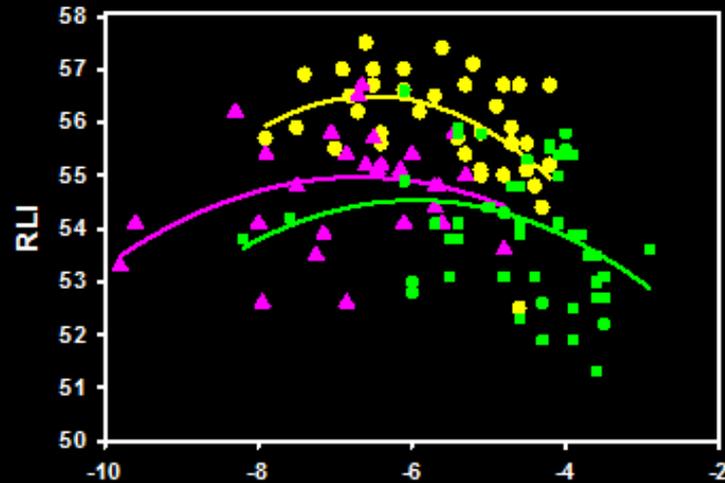


Nuts located on elongating shoots will often be shriveled due to competition from the vegetative growth

Sunburn can also result in kernel damage including shrivel and discoloration

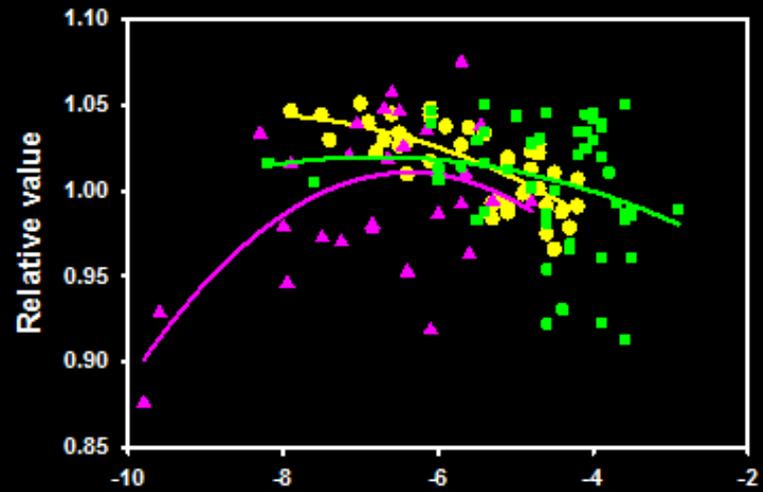


wetter



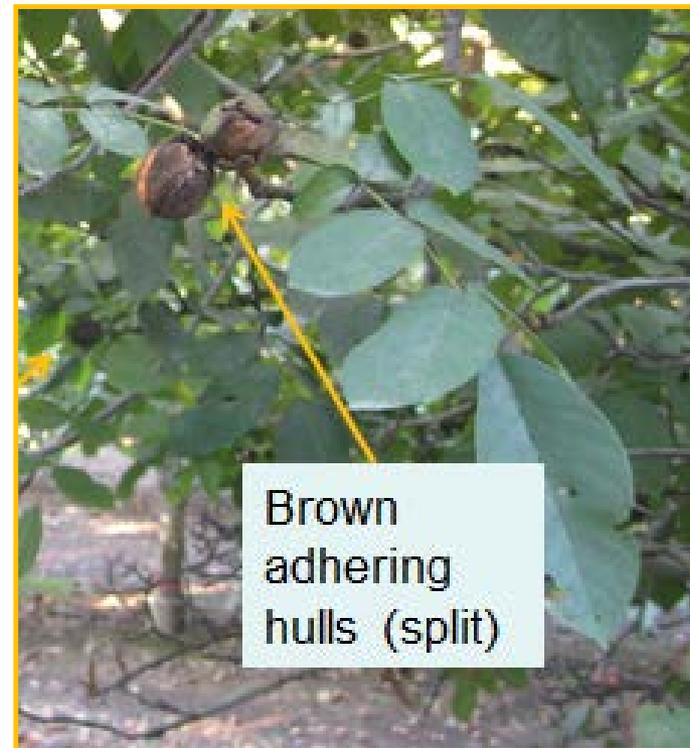
- Walnut quality Chandler 2007
- ▲ Nickels Howard 2007
- Nickels Howard 2008

Seasonal average midday stem water potential (bars)



Seasonal average midday stem water potential (bars)

- All of the quality factors I have been talking about are related to current year conditions
 - There are also quality impacts that are due to previous year conditions





Both in full light positions



Pee wee nuts

Pee wee nuts

- 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
- Resulting from buds that formed in low light position the previous year and had limited carbohydrate reserves
- Even if these positions are then exposed to full light due to hedging or pruning they still only produce small nuts



← Brown adhering hulls with medium sized nuts, often good color but sometimes have discolored pellicles- less extreme case of pee wee



Outer exposed nut- normal split



Black adhering hull- no split



Brown adhering hull- split



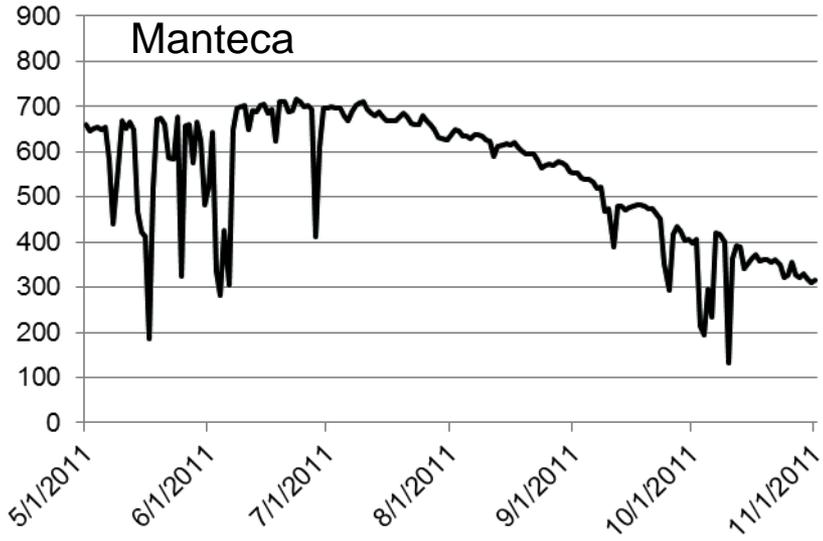
Pee wee nuts

What other conditions can contribute to quality problems?

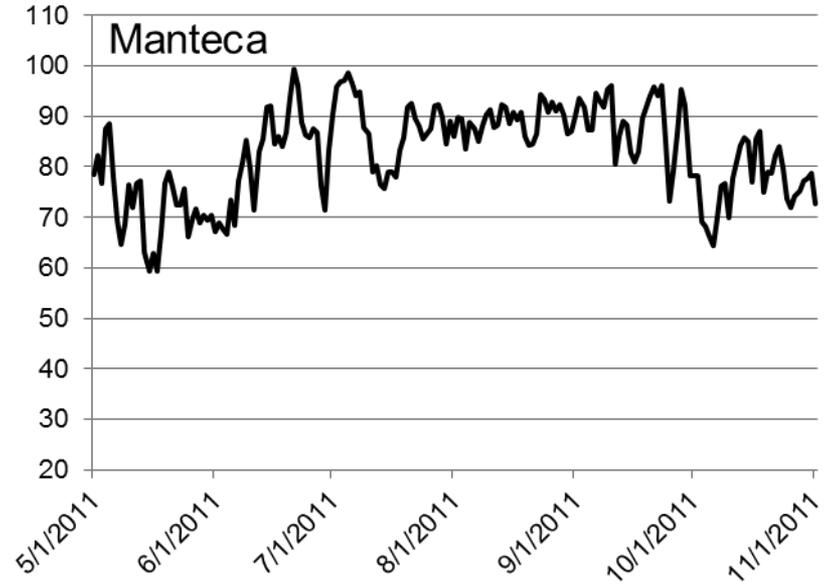


Cloudy May/June delayed development

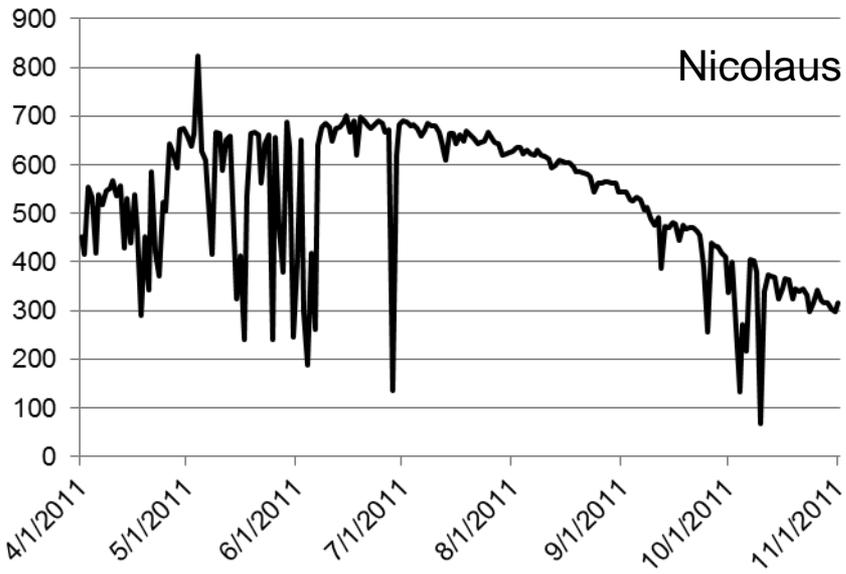
Solar radiation (Ly/day)



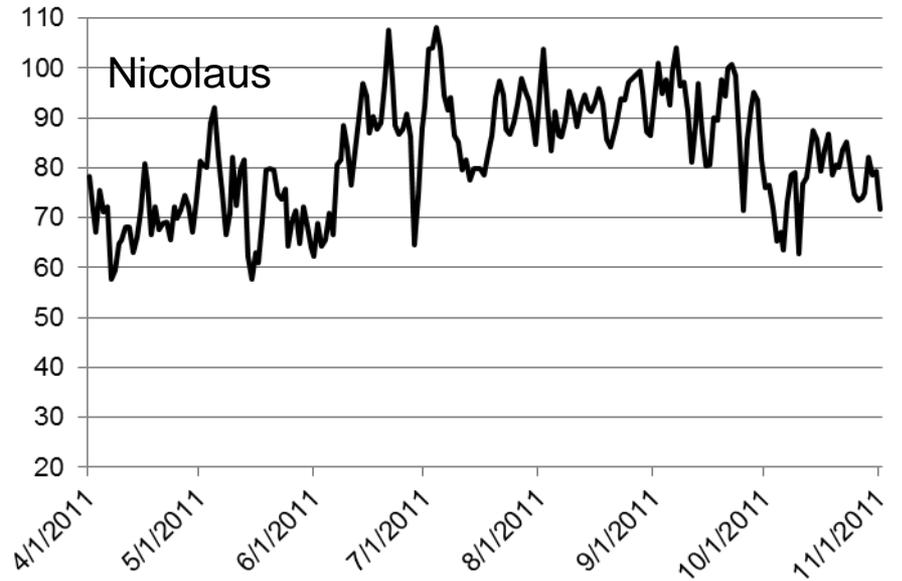
Max Air Temp (°F)



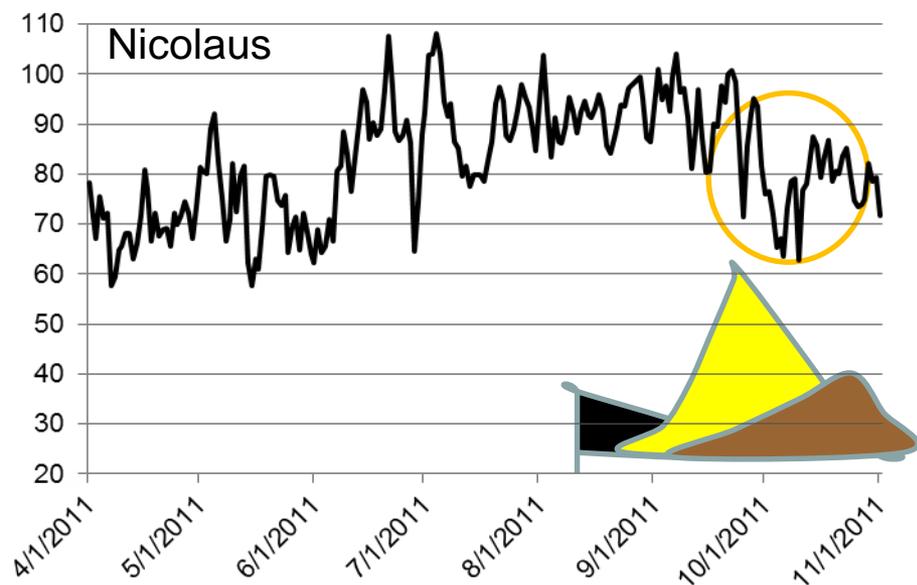
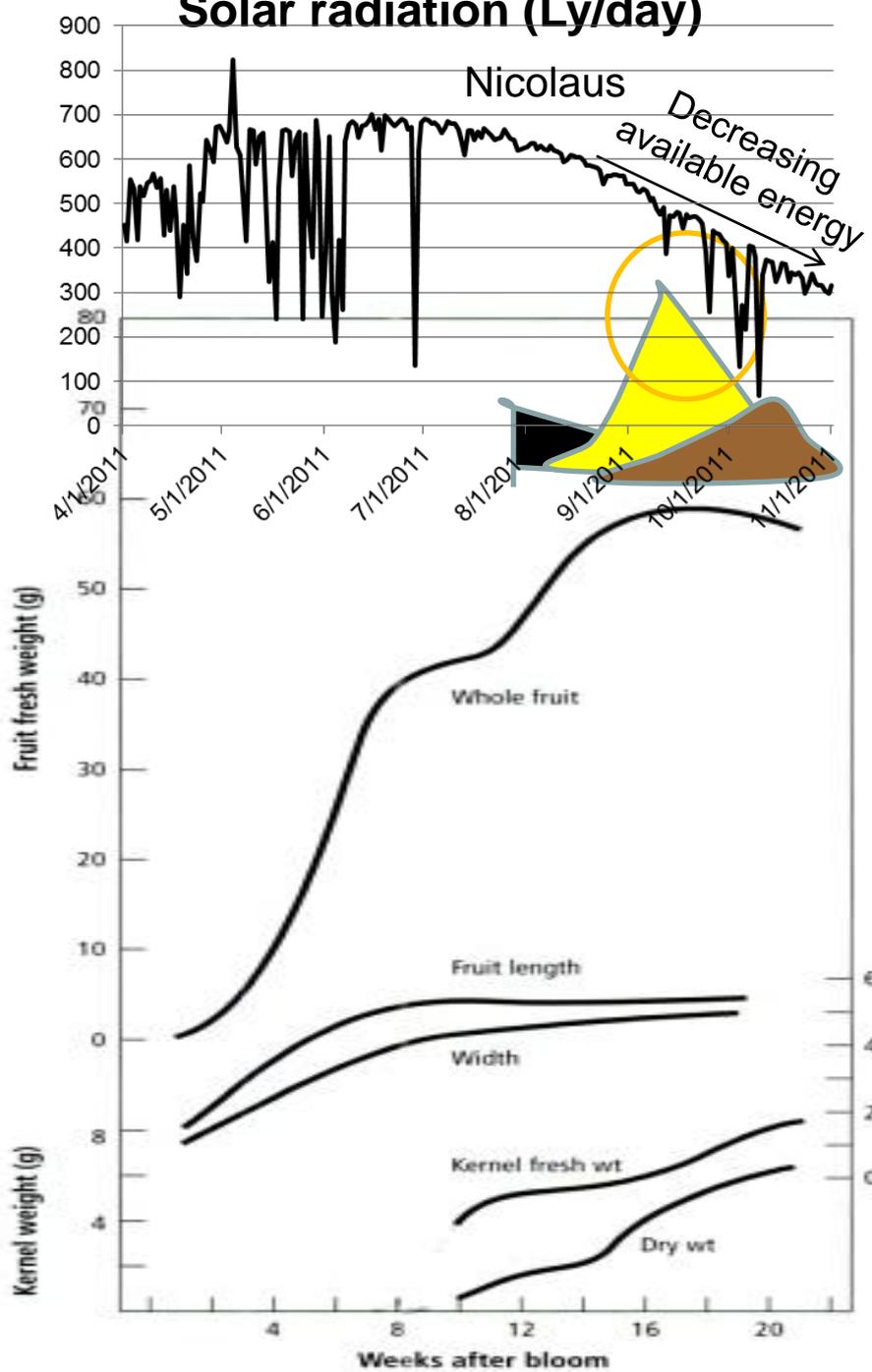
Nicolaus



Nicolaus



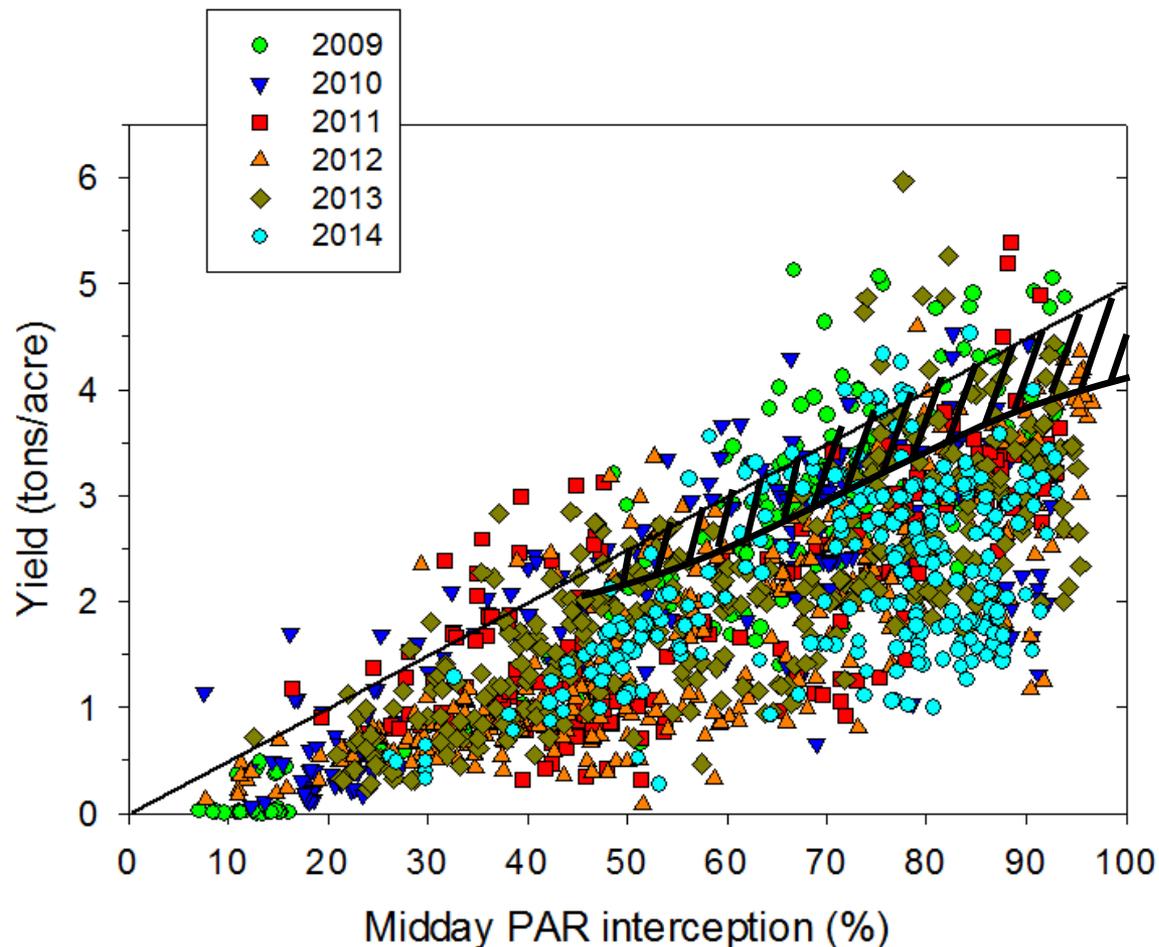
Solar radiation (Ly/day)



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

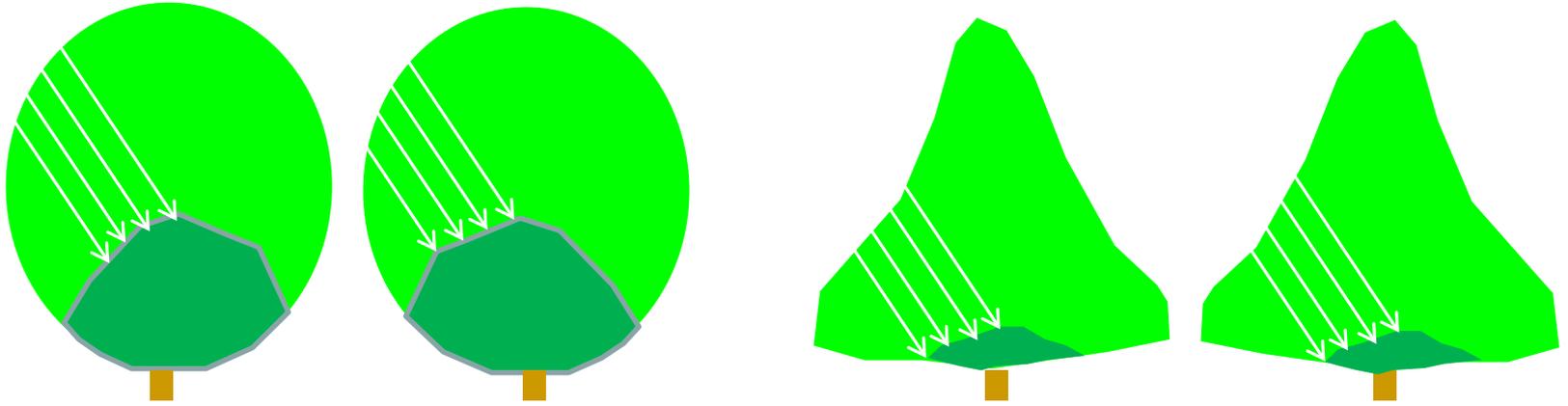
Figure 18.3. Growth of the walnut fruit and kernel as a function of

- 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

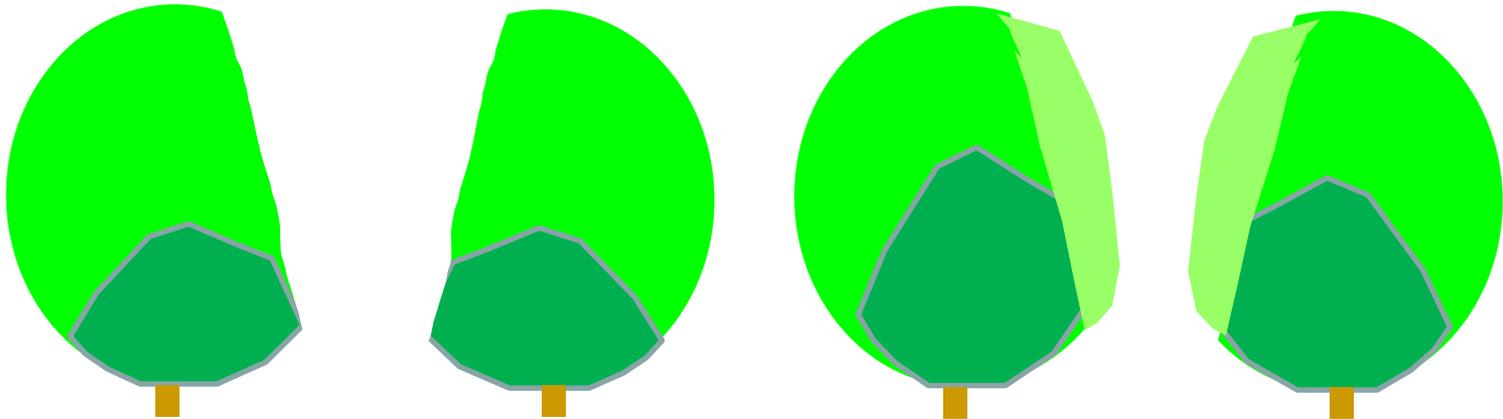


In order to keep lower canopy positions alive and productive, at least $\frac{1}{2}$ hour of direct sunlight is required. As orchard gets above about 70% midday canopy light interception (or yields above 3 to 3.5 tons/ac), these lower positions will be continually shading out due to lack of light and quality problems are likely to result.

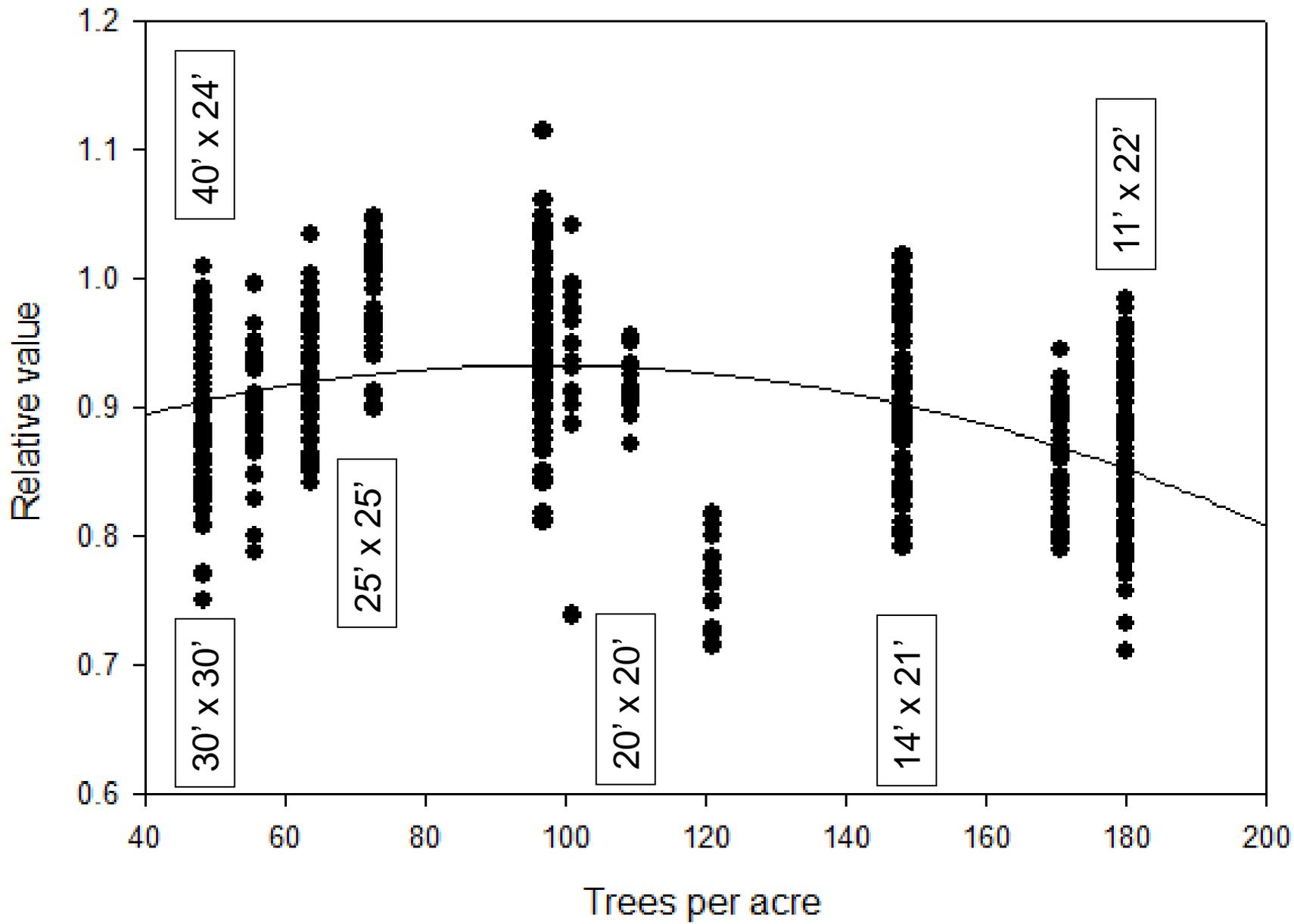




Quality problems in center of tree tend to be less severe with central leader tree structure- shorter light path through tree



Most severe quality problems occur in orchards planted in hedgerow configuration and mechanically hedged- due to dense vegetative growth in response to cut and exposing positions that were currently shaded to full sun



- Factors that can effect walnut quality
 - Variety
 - Leaf loss- shading, disease or water stress
 - Water stress damage without leaf loss
 - Competition from vegetative growth on elongating shoots
 - Sunburn
 - Insect damage to hull (husk fly)
 - Shaking nuts with green hulls and not removing hulls promptly
 - Nuts being wetted on orchard floor by irrigation or rainfall
 - Hot conditions during harvest

Nut quality problems can be associated with current year conditions or previous year conditions

- Current season carbohydrate deprivation resulting from water stress (lack or excess) and/or shading related leaf loss

Thin shell	June
Severe shrivel	early July
Slight shrivel	early Aug
Yellow pellicle	early Aug
Black pellicle	mid- Aug
Bronze pellicle	late Aug/early Sept

- Previous season problem due to insufficient carbohydrate storage in bud formed during the previous season resulting in small leaves and small nut(s)

Often associated with bud that developed in relatively shaded position previous year

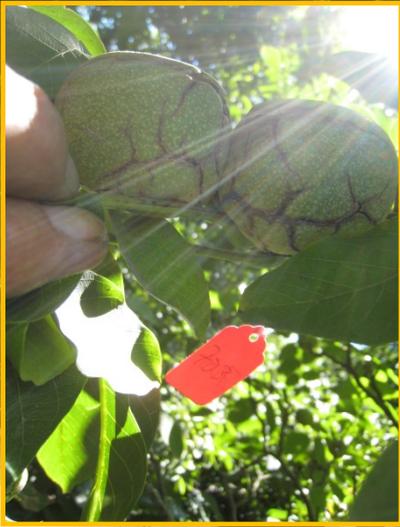
- Very weak bud = peewee
- Relatively weak bud = brown adhering hull

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?