PRODUCING QUALITY PRUNES

IPA International Congress
November 8, 2016

Joe Turkovich
Grower,
California Dried Plum Board Chairman,
Sunsweet Board Member

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NEW INSIGHTS FROM UC DAVIS DEPARTMENT OF PLANT SCIENCES

Ted DeJong, Professor & Pomologist
Maciej Zwieniecki, Associate Professor
Astrid Volder, Associate Professor

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The Fundamentals

The overall objective:

- Maximize resource capture and use
- Achieve sustainable economic yields

What resources are we mainly interested in?

- Light energy
- Carbon
- Oxygen
- Water
- Nutrients

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What are the three most prominent chemical elements in dry plant parts?

- Carbon C
- Hydrogen H
- Oxygen O
- (Roughly in a ratio of 40:7:53)

Where does all that C H O come from?

- PHOTOSYNTHESIS!

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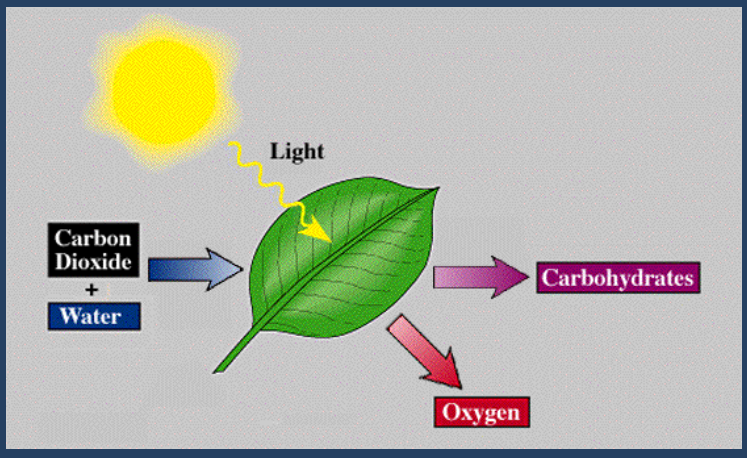
Plants Convert Sunlight Into Carbohydrate



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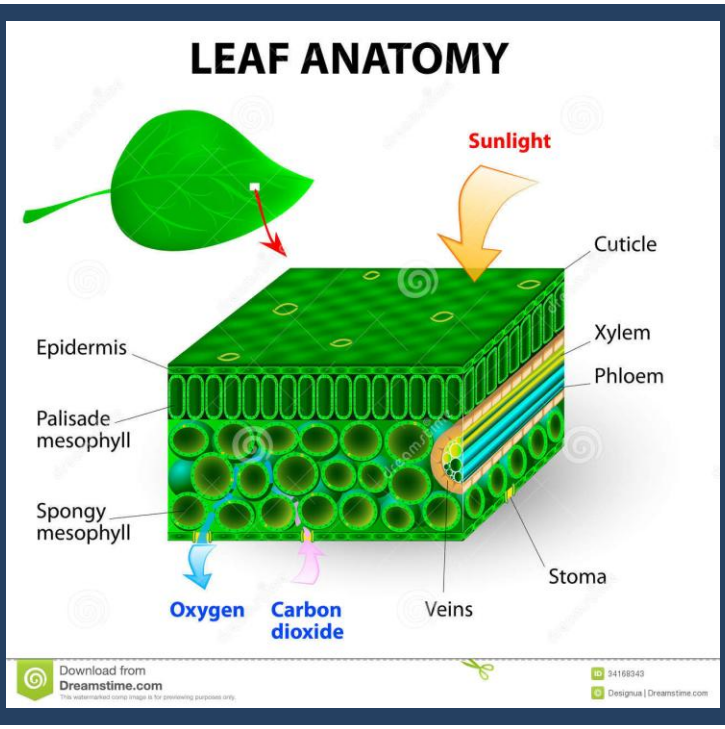
LEAF ANATOMY



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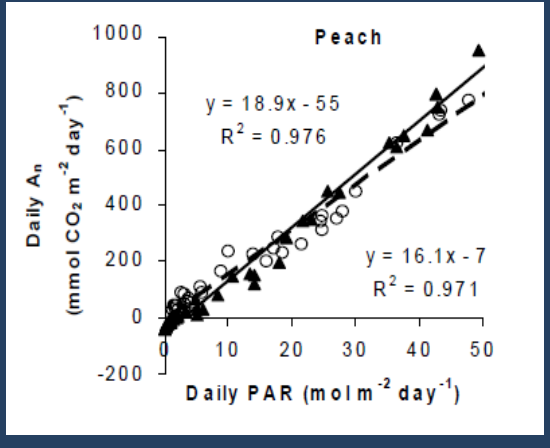
Think of Plants as Solar Collectors

Under non-stress conditions, canopy photosynthesis is a direct function of the light intercepted by the canopy during a day.

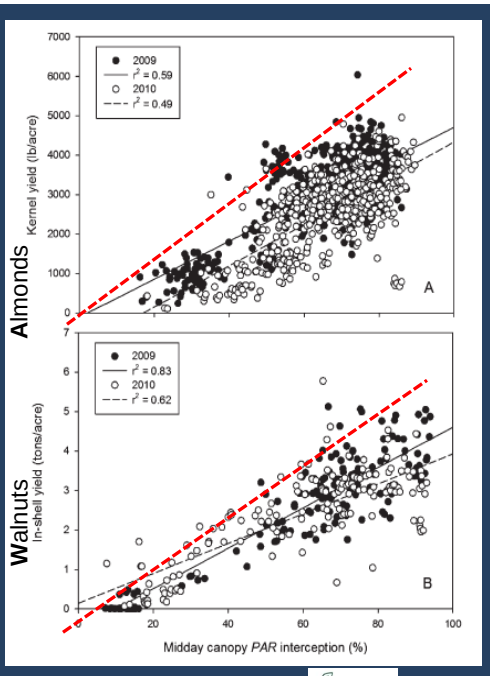


Rosati, et al. 2002. Acta Hort. 584: 89-94

UCDAVIS PLANT SCIENCES

If light interception is related to crop yield, why is there so much scatter in all of these points?

- Poor tree spacing
- Poor water management
- Poor nutrient management
- Poor disease and pest control
- Etc.

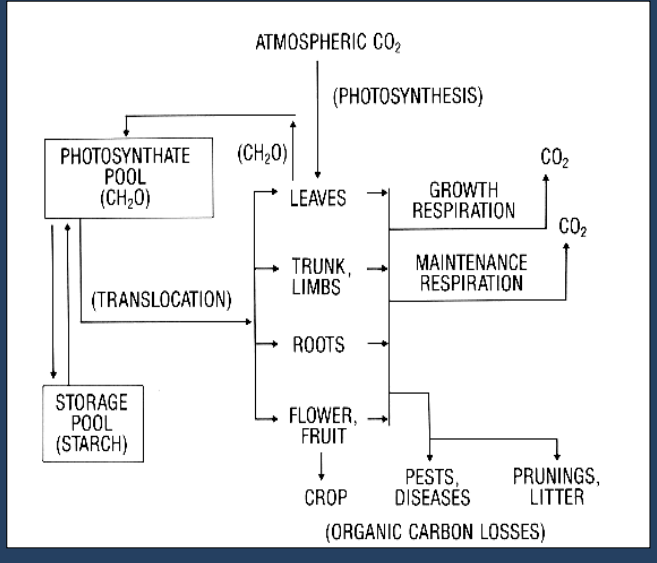


Lampinen, et al.,2012

Carbon Distribution Within the Tree

The translocated CH_2O's are mainly sorbitol, sucrose and glucose.

(This is a conceptual diagram of where the CH_2O's go but how does that happen?)



Carbon Distribution Within the Tree

The tree provides resources (CH_2O, H_2O, nutrients), tree organs use them.

- ***Organ use of resources*** is dictated by ***organ growth and development***.
- ***Organ development and growth*** dictate tree growth and fruit production (**not *vice versa***).

Why does this matter? You need to ***manage trees to optimize resource capture*** and you need to ***manage organs to optimize organ growth to attain high crop yields***.

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Carbohydrate Management

- Carbohydrates provide 'fuel' energy to the tree
- Carbohydrates are the tree's 'liquid assets'
- Soluble carbohydrates are like 'cash' to a tree
- Trees continuously measure soluble sugar levels
- Starch is the tree's energy savings account

Maciej Zwieniecki, 2015

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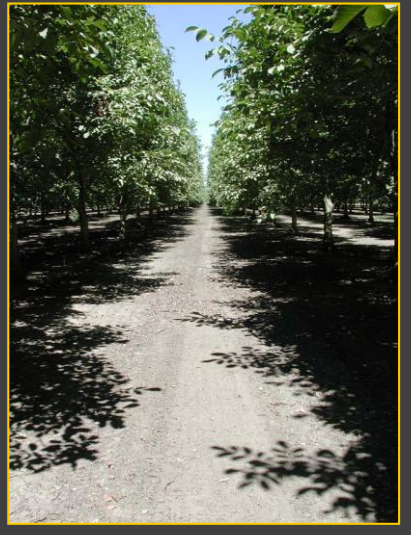
Carbohydrate Management

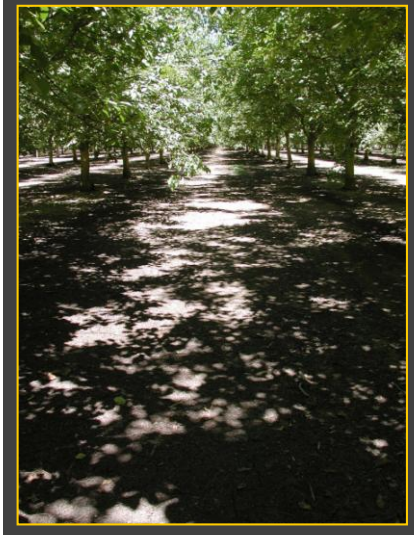
Currently we do not manage orchards for carbohydrates or use carbohydrate analysis to inform management practices.

Orchard Design

Bruce Lampinen on Walnut Production, Plant Sciences UC Davis



~70% midday light interception



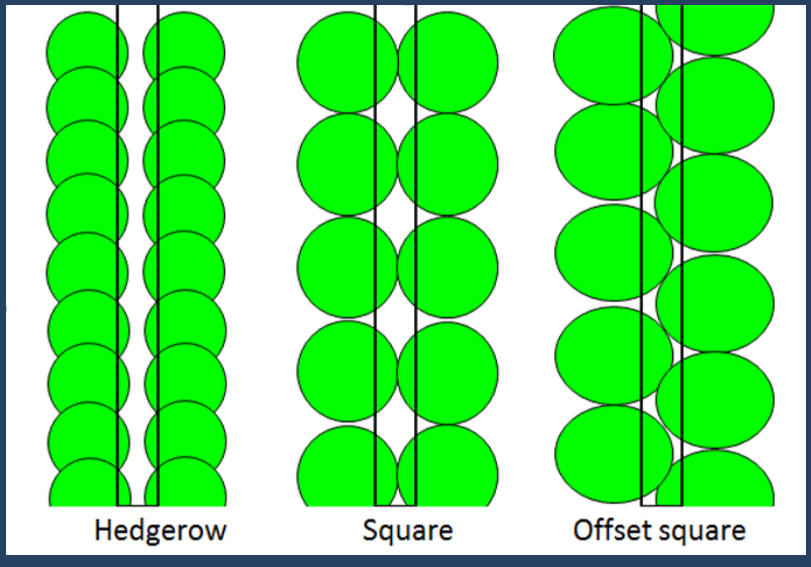
~90% midday light interception 14

Factors influencing how fast an orchard comes into production:

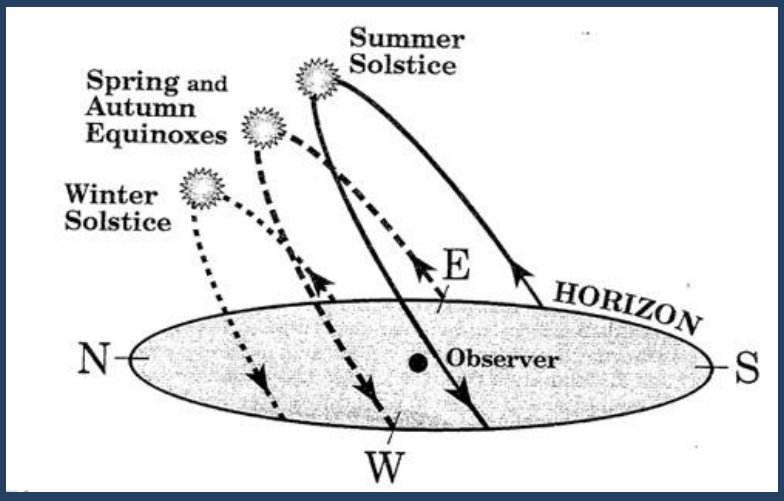
- Microclimate
- Soil characteristics
- Rootstock
- Variety
- **Tree spacing/configuration**
- Orchard floor management
- Pruning/training
- Irrigation management
- Nutrient management

Once you have planted the orchard these choices can't be changed.

Tree Spacing



Path of the Sun
(Southern Hemisphere)



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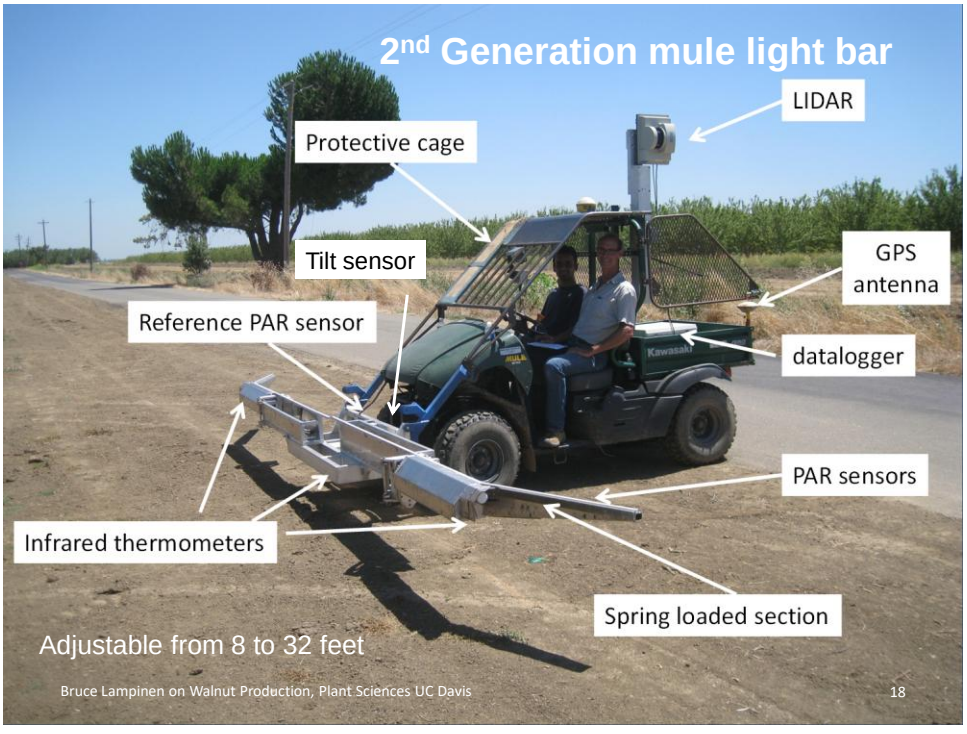
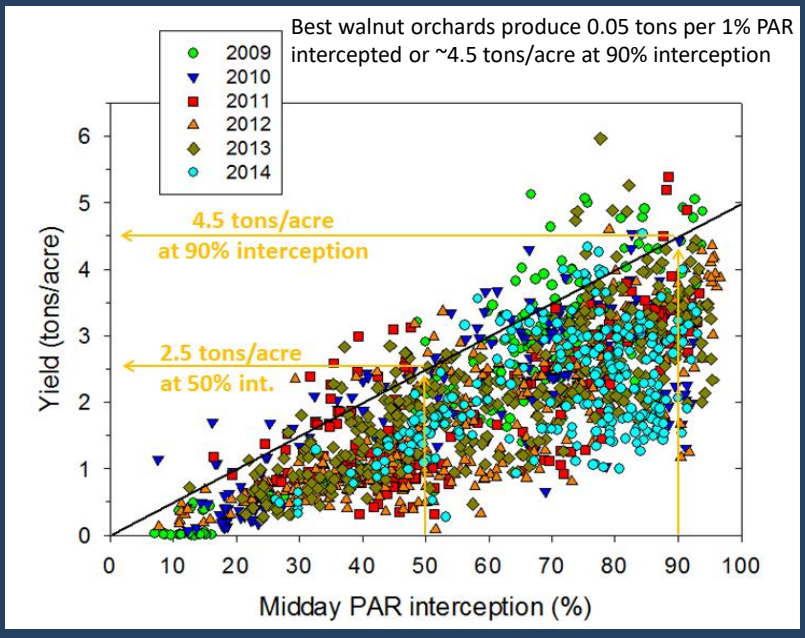
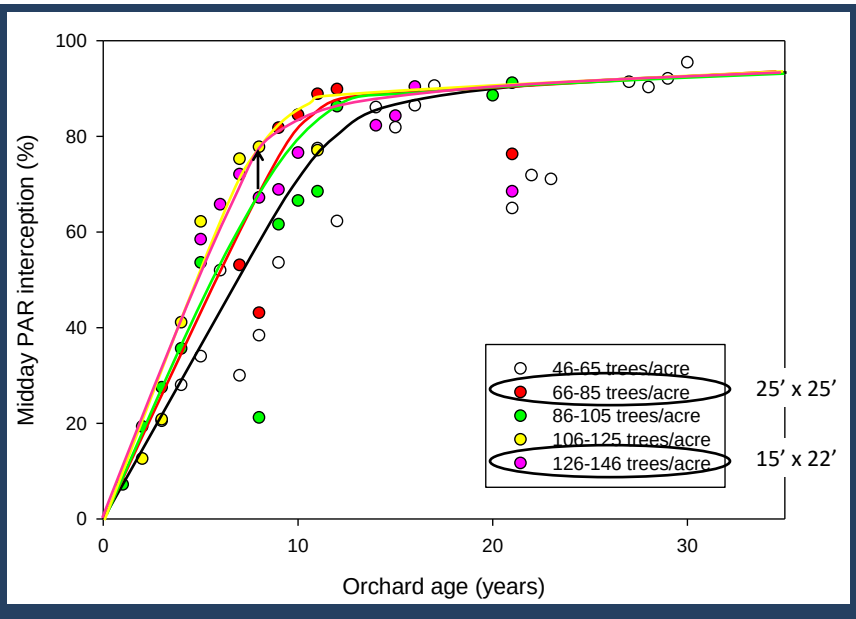


Best walnut orchards produce 0.05 tons per 1% PAR intercepted or ~4.5 tons/acre at 90% interception





Key Points About Orchard Design

- Tree spacing and configuration decisions needs to be done in conjunction with:
  - Soils information
  - Rootstock
  - Variety
- Tree spacing/configuration choice is one of the most important decisions impacting long term productivity of orchard

PRUNE CROP LOAD MANAGEMENT

Prunes are not almonds or walnuts.

Maximum production ≠ maximum returns.

- Franz Niederholzer, UCCE Farm Advisor

The least understood aspect of prune production. Farmer either get it, or they don't!

- Franz Niederholzer, UCCE Farm Advisor

California's Improved French Cultivar Naturally Bears a Lot of Small Fruit

dry ct / lb	% undersize
50	4
60	6
70	11
80	17
90	24
100	34
110	44

Source: Southwick, et al: Confirmation of Fitch et al. data, 1975 & PBA data, 1991 on the relationship of % undersize to dry ct/lb of "French" prunes - 1996 report

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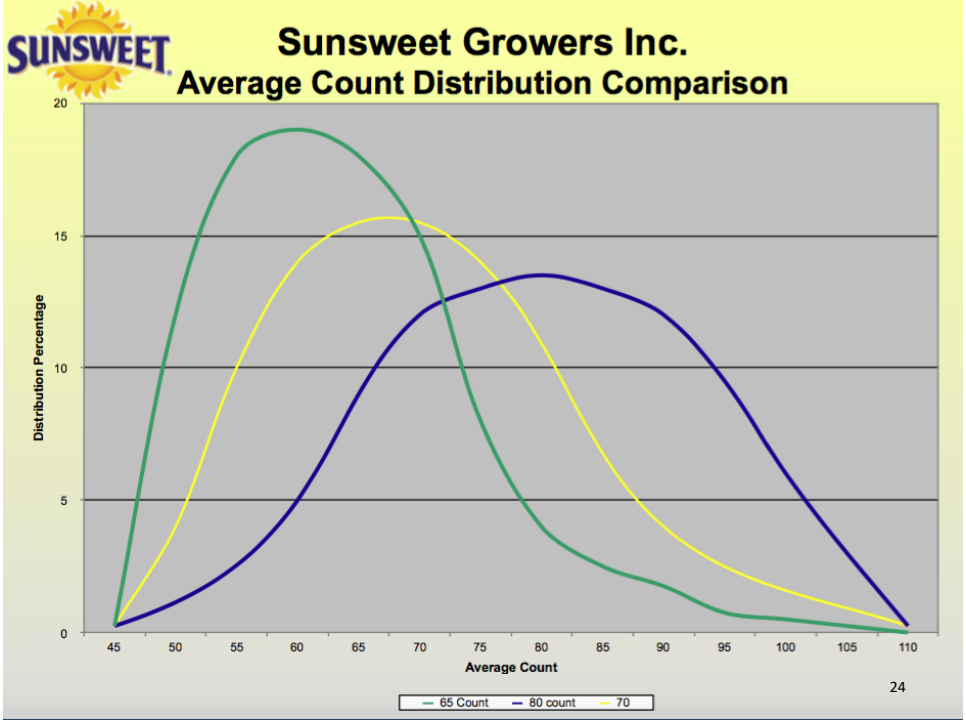

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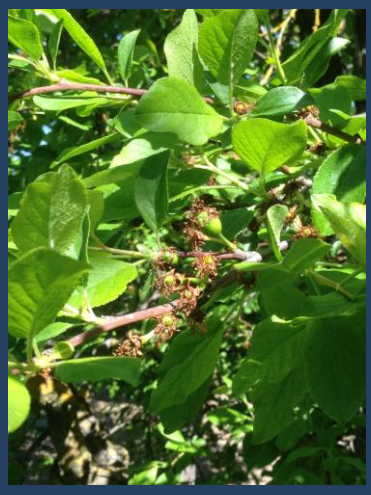
Only 15-20% of Flowers Need to Set to Make a Full Crop



Photos by Joe Turkovich

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Crop Load Management Begins With Pruning

Photo by Joe Turkovich

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Many Methods are Used in California

Photo by Joe Turkovich

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Photo by Joe Turkovich

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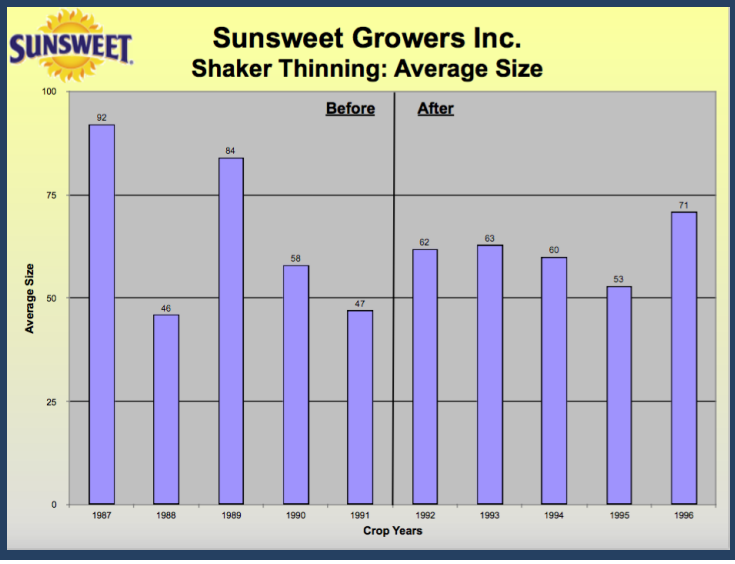
Alternate Bearing is Reduced With Mechanical Thinning



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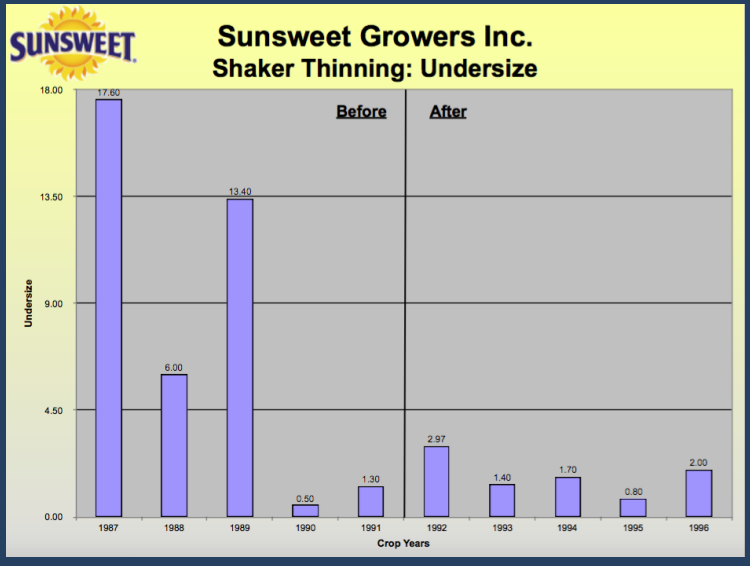
Less Undersized Fruit With Mechanical Thinning



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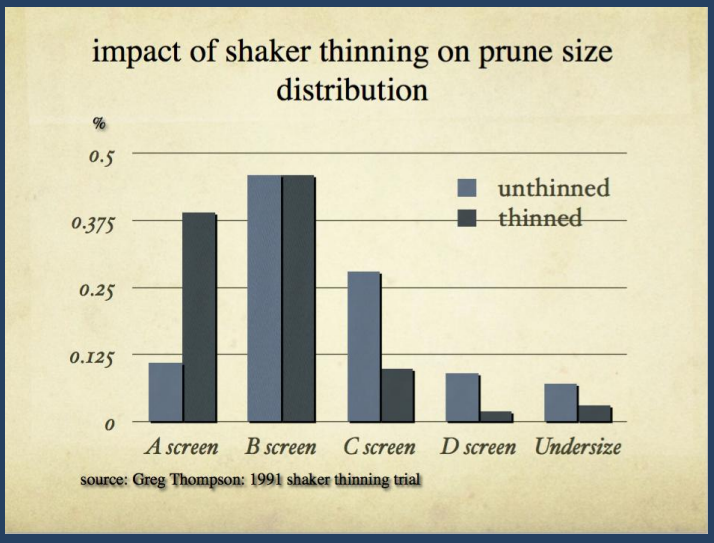
Mechanical Thinning Shifts the Crop to More Marketable Sizes



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Thinning = Less Tons, More Dollars

- Size count went from 85/lb to 62/lb
- Marketable tons decreased by 22%
- Overall financial returns improved

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Effect of Fruit Thinning on Fruit Size and Quality

Allan Fulton, Richard Buchner, Mark Gilles, Cyndi Gilles and Stephen Ferguson

Thank you Sunsweet for fruit grading data.

Designed as a grower demonstration.

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Thinning Timing: Development of Endosperm

Photo by Joe Turkovich

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Photo Courtesy of Richard Buchner

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Photo by Joe Turkovich

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Photo Courtesy of Richard Buchner

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Photo by Joe Turkovich

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Harvest Characteristics Organized by Treatment Means

CROP LOAD VS. DRY RATIO & SCREEN SIZE

Time	#prunes/tree	Dry Ratio	%A	Dry count/lb	Brix	Pressure
1.75	1936	2.89	70	47.2	24.8	4.7
1.25	2340	3.06	56	54.9	24.2	4.4
0.75	3852	3.06	51	55.5	24.3	4.5
No Shake	**3442**	**3.34**	**23**	**72.9**	**20.6**	**4.2**

Thinning improved dry ratio, dried count per pound, brix and pressure.

Source: Richard Buchner

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When to Harvest?

Photo by Joe Turkovich

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Fruit Pressure Readings

Photo by Joe Turkovich

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Brix Levels Tested

Photo by Joe Turkovich

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What to do With Small Fruit?
Mechanical Sizers

Photo Courtesy of Franz Niederholzer

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Photo by Joe Turkovich

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Small Fruit Left on Ground

Photo by Joe Turkovich

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Unusually Large Piles Due to Heavy Crop of Small Fruit

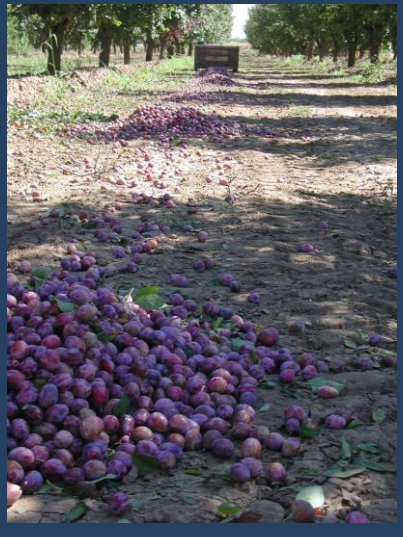

Photo by Joe Turkovich

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Prunes Just Out of the Dehydrator

Photo by Joe Turkovich

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How Do We Measure Quality?

Photo by Joe Turkovich

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Dried Fruit Association (DFA) Serves as a 3rd Party Inspection Service…..

Dehydrator

Packer/ Processor

DFA Inspection
(Natural Condition Prunes)

Photos Courtesy of DFA of CA

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Sample Collection

DFA Samplers collect samples at Dehydrator sites per Packer's Request

Sample Size
- Composite Sample (~40 lbs./18 kg) per load
- Load/Lot size = 1 - 30 bins
  - (~60,000 lbs./27,000 kg)

Sample is Tagged and Documents completed for Traceability

Photo Courtesy of DFA of CA

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Samples Verified and Weighed

Photos Courtesy of DFA of CA

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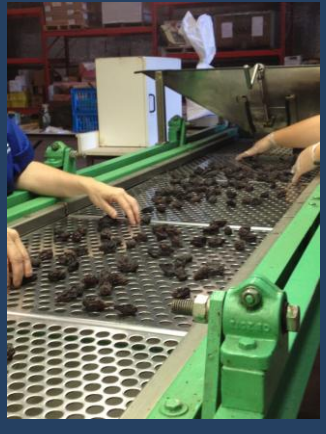
Grading for Size by Screening



Photos Courtesy of DFA of CA

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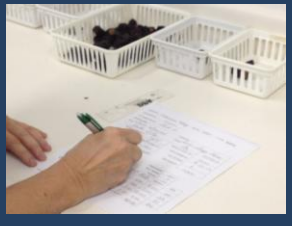
Quality Inspection

Test Base Determined

Defect Analysis



Results Recorded on Certificate of Inspection

Photos Courtesy of DFA of CA

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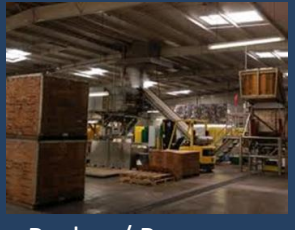
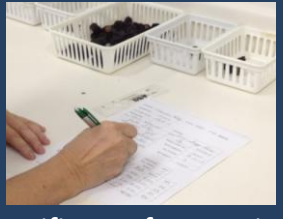
Grower Payment



Packer / Processor



Certificate of Inspection

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Grower

Photos Courtesy of DFA of CA

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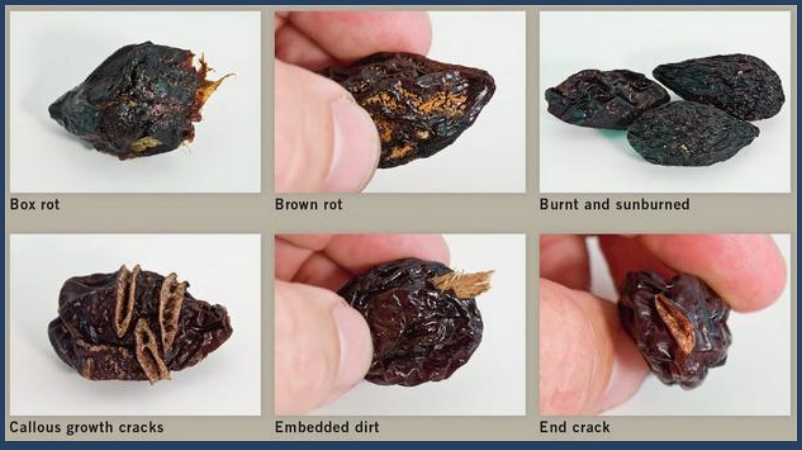
Prune Defects



Buchner, Rich. *Prune Defects.*
Prune Production Manual, 2012

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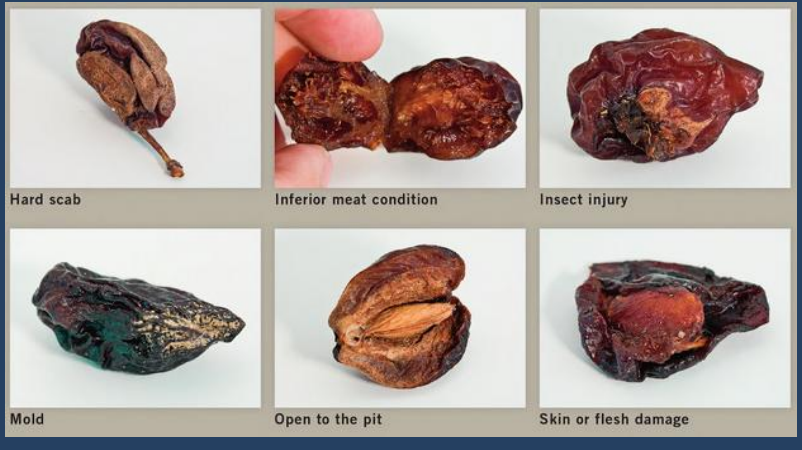
Prune Defects



Buchner, Rich. *Prune Defects.*
Prune Production Manual, 2012

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Prune Defects
Sun Scorch

Photo by Joe Turkovich

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Scorched Fruit Can Release Toxins that Kills Branches

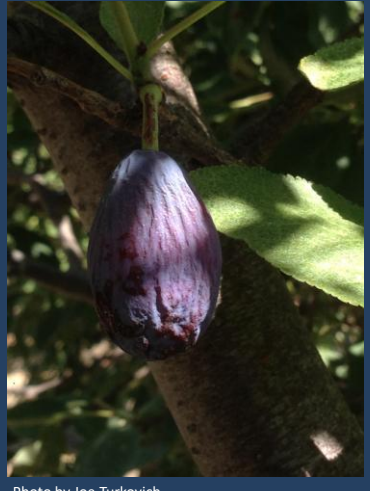

Photo by Joe Turkovich

Photo by Richard Buchner

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Location Affects Sunlight Intensity

Location	Latitude	Elevation	Sun Angle
Agen, FR	42.20 N	48 m	80 deg
Yuba City, CA	39.14 N	18 m	84 deg
San Rafael, AR	34.64 S	**704 m**	**89 deg**
Griffith, AU	34.28 S	138 m	**89 deg**
Santiago, CL	**34.45 S**	577 m	**89 deg**

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Sun Burn Protectant

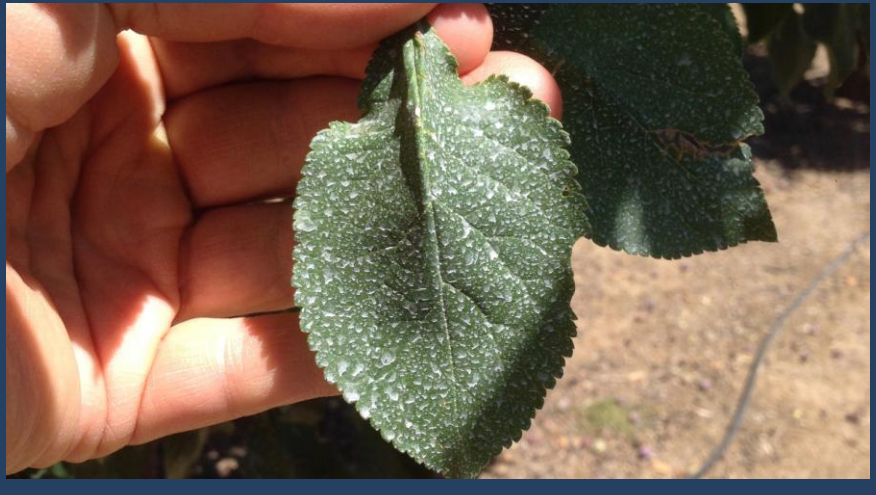

Photo by Joe Turkovich

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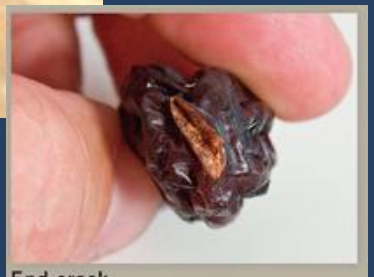
End Cracks

Photo by Joe Turkovich



End crack

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Side Cracks

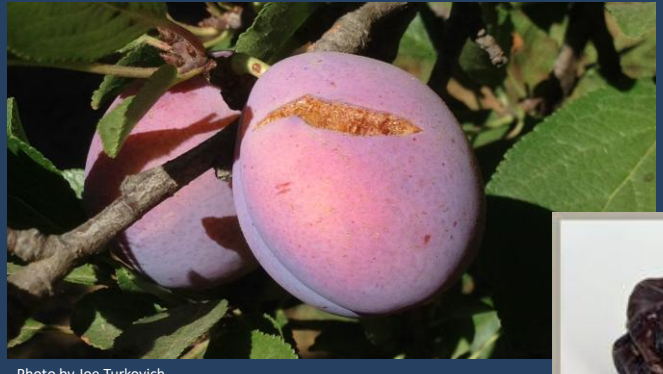

Photo by Joe Turkovich

Callous growth cracks

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Insect Damage

Photo by Joe Turkovich

Insect injury

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Scab or Russeting

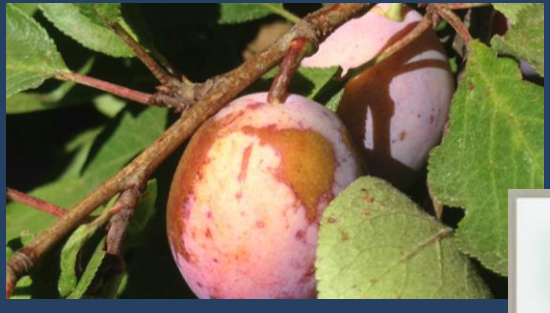

Photo by Joe Turkovich

Soft scab

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Hail Damage

Photos by Joe Turkovich

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Harvester Damage

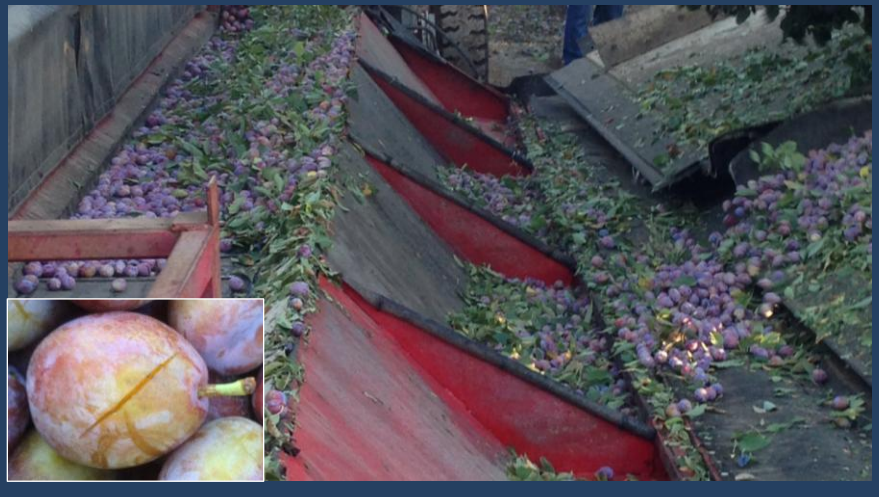

Photo by Joe Turkovich

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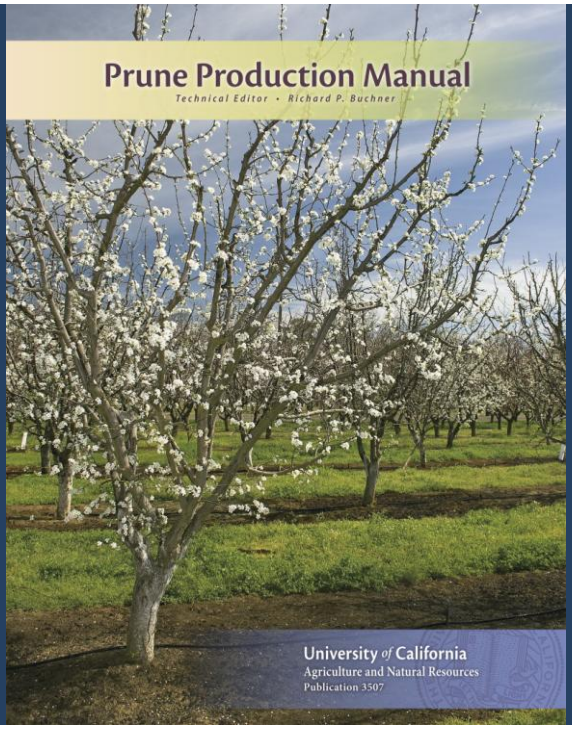

Source: UC ANR publication

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Conclusion

- Sunlight management determines yield & quality
- Orchard design and tree population is critical
- Attention to basics is a must (irrigation, fertilization, disease & pest control, etc.
- Crop load management evens out annual size variation and nets the greatest return / acre

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