Integration of Tree Density & Minimal Pruning for Efficient Almond Production

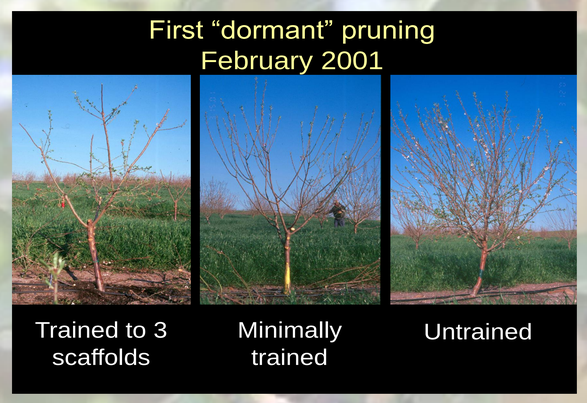
Roger Duncan, UC Cooperative Extension, Stanislaus County & Bruce Lampinen, UC Davis

Objectives:

- Test if almond trees need to be pruned annually to maintain light permeation throughout the canopy, sustain bud fruitfulness, renew fruitwood, control tree size (height) and maintain the productive lifespan of an orchard.
- Determine the optimal orchard spacing for large trees (Nonpareil variety on hybrid rootstock) vs. smaller trees (Carmel variety on nemaguard rootstock).
- Monitor long term effects on yield, orchard longevity and profitability.

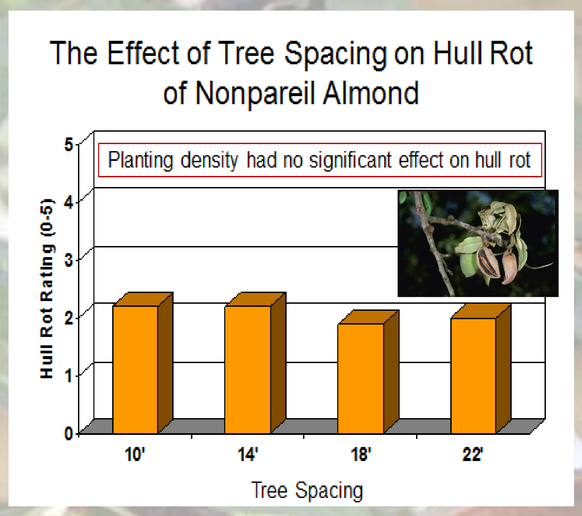
Multifactorial Trial:

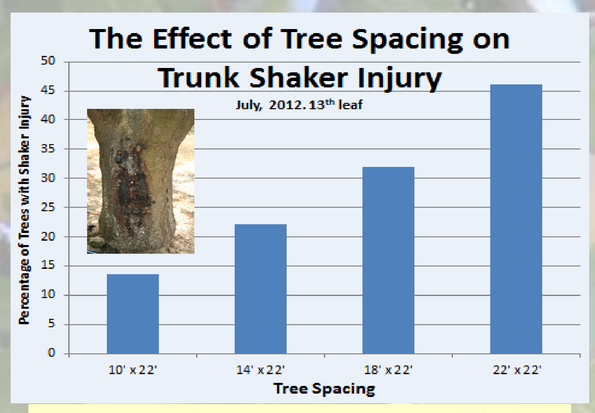
- 2 Varieties
  - Nonpareil & Carmel
- 2 Rootstocks
  - Nemaguard & Hansen
- 4 Tree spacings
  - 22'x22, 18'x22', 14'x22', 10'x22'
- 4 Pruning strategies



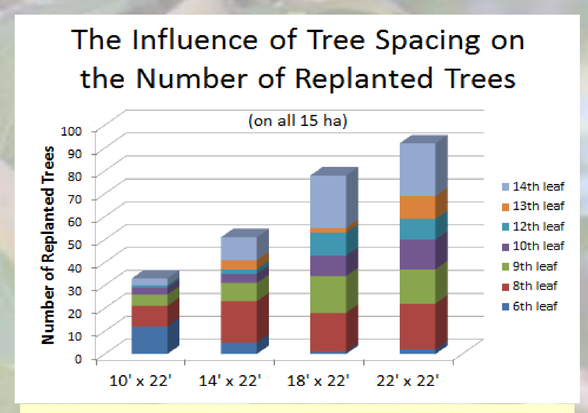
Pruning Strategies:

1. Standard trained, standard pruned
   - 3 scaffolds, annual moderate pruning
2. Standard trained, then unpruned
   - Trained with 3 scaffolds and open centers
   - Unpruned after 2nd dormant season
3. Minimal training & pruning
   - Trained with 4-6 scaffolds & open centers
   - Maximum of three pruning cuts annually
4. Untrained, unpruned
   - No scaffold selection, no annual pruning

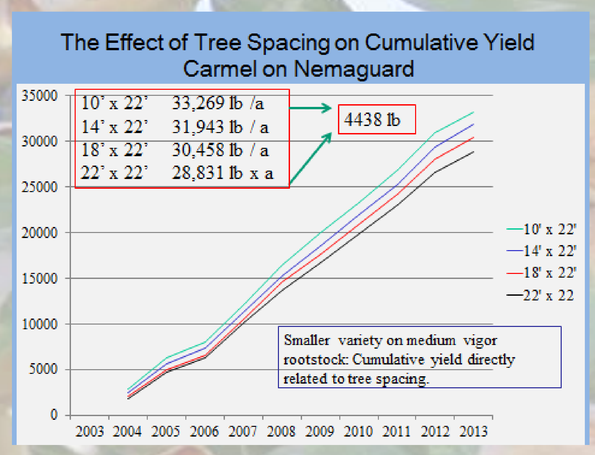


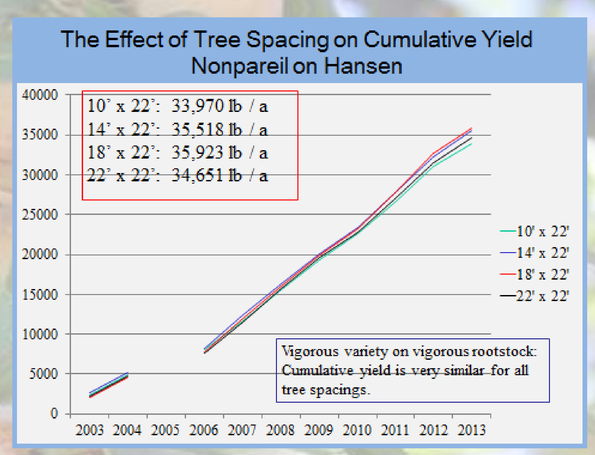


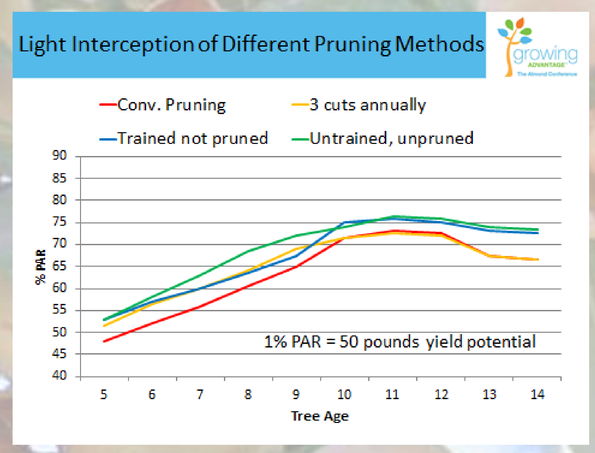
Widely spaced trees are larger, more difficult to shake and therefore more prone to shaker injury

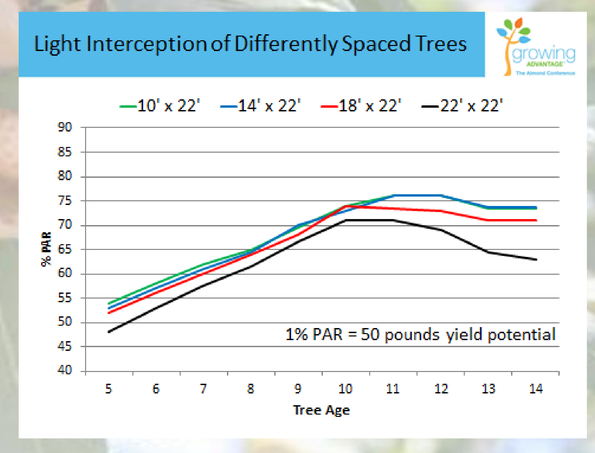


The closer trees are planted, the less likely they will die due to scaffold failure or shaker damage









The Effects of Pruning, Tree Spacing & Rootstock on Current (14th Leaf) & Cumulative Yield

	Nonpareil		Carmel	
	2013 Yield (lb/acre)	Cumulative	2013 Yield (lb / acre)	Cumulative
Training & Pruning				
Trained to 3 scaffolds; Annual, moderate pruning	2908 a	32,246	1995 a	27,615
Trained to 3 scaffolds; unpruned after 2nd year	2811 a	33,481	2029 a	29,564
Trained to multiple scaffolds; Three annual pruning cuts	2812 a	31,581	2127 a	29,207
No scaffold selection; no annual pruning	2942 a	33,625	2083 a	30,919
Tree Spacing				
10' x 22'	2922 a	32,793	2129 a	30,453
14' x 22'	2992 a	33,392	2153 a	30,387
18' x 22'	2875 a	33,003	2048 a	28,924
22' x 22'	2683 b	31,742	1905 a	27,542
Rootstock				
Hansen	3131 a	32,665	1945 a	27,068
Nemaguard	2605 b	32,800	2172 a	31,566

There are many reasons to prune an almond orchard. Yield does not appear to be one of them.

Conclusions after the first 14 years:

Tree Training & Pruning:

- Annual pruning has not maintained canopy light interception longer than unpruned trees
- In most years Nonpareil yields are statistically similar in conventionally pruned, minimally pruned and unpruned trees while Carmel yields are higher in unpruned trees.
- Cumulatively, untrained & unpruned Carmel trees have accumulated 3304 pounds more than conventionally pruned trees through the 14th leaf.
- At $2.00 / pound, conventional training and pruning would have reduced gross income by about $6600 per acre so far in this trial, including pruning & shredding costs plus lower cumulative yield.
- Trees trained to multiple scaffolds are more prone to scaffold failure and tree blow over (young trees), especially in widely spaced trees.
- Pruning has not affected kernel size.

Tree Spacing:

- There has been no clear yield advantage to high density planting of Nonpareil so far.
- Cumulative Carmel yields are significantly higher on closely planted trees and the trend is continuing.
- More closely planted trees have significantly smaller trunk circumference and canopy width, and to a lesser extent, shorter tree height.
- Because closely planted trees are smaller, they have had fewer problems with scaffold breakage, are easier to shake, have fewer mummies, have suffered less trunk injury during mechanical harvest, have the fewest replants and may have a longer productive life..
- Sunlight interception is decreasing faster in widely spaced trees which may lead to prematurely declining orchard yields earlier than closely spaced trees.
- Closely planted trees have not had more hull rot (bread mold) than widely spaced trees