Integration of Tree Density & Minimal Pruning for Efficient Almond Production

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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 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, nut quality, disease and orchard 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

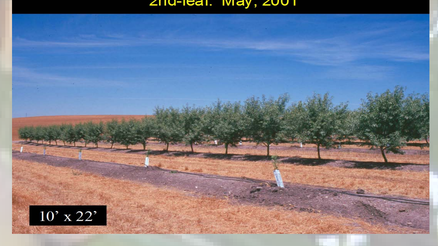
Pruning Strategies:

1. Standard trained, standard pruned
   - 3 scaffolds, annual pruning, open centers
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

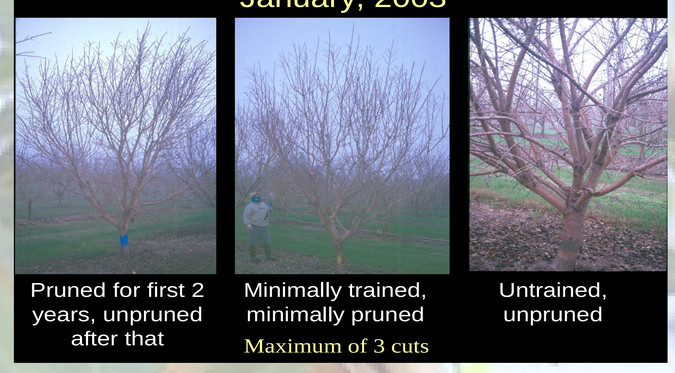
First "dormant" pruning
February 2001

Trained to 3 scaffolds | Minimally trained | Untrained

Standard trained & pruned vs. Untrained & unpruned
2nd-leaf. May, 2001

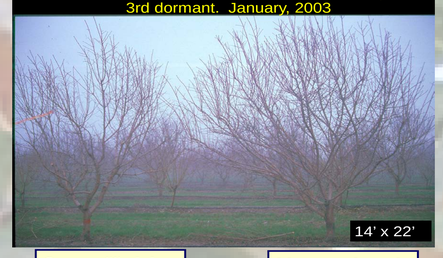


Third dormant pruning
January, 2003



Pruned for first 2 years, unpruned after that | Minimally trained, minimally pruned — Maximum of 3 cuts | Untrained, unpruned

Standard trained & pruned vs. Untrained & unpruned
3rd dormant. January, 2003



3 scaffolds, annually pruned | Not trained, not pruned

Untrained trees are more prone to scaffold failure than trees trained to three scaffolds

The Effects of Pruning, Tree Spacing & Rootstock on Current (12th Leaf) & Cumulative Yield

	Nonpareil		Carmel	
	2011 Yield (lb/acre)	Cumulative	2011 Yield (lb / acre)	Cumulative
Training & Pruning				
Trained to 3 scaffolds; Annual, conventional pruning	4049 a	25,129 ab	3006 b	22,494 b
Trained to 3 scaffolds; unpruned after 2nd year	4132 a	26,283 a	3079 b	24,027 a
Trained to multiple scaffolds; Three annual pruning cuts	3871 a	24,790 b	3084 b	23,772 ab
No scaffold selection; no annual pruning	4173 a	26,463 a	3380 a	25,151 a
Tree Spacing				
10' x 22'	4032 ab	25,643 a	3202 a	24,888 a
14' x 22'	4130 ab	26,262 a	3232 a	24,780 a
18' x 22'	4205 a	25,794 a	3110 a	23,348 b
22' x 22'	3853 b	24,976 a	3005 a	22,429 c
Rootstock				
Hansen	4402 a	25,064 a	2929 b	22,219 b
Nemaguard	3710 b	26,268 a	3346 a	25,503 a

Conclusions after 12 years:

- In most years Nonpareil yields are statistically similar in conventionally pruned, minimally pruned and nonpruned trees.
- Cumulatively, unpruned Nonpareil trees have yielded 1330 pounds more than conventionally trained & pruned trees.
- In most years, Carmel yields are highest in the untrained and unpruned trees.
- Cumulatively, unpruned Carmel trees have yielded 2654 pounds more than conventionally pruned trees.
- Conventional training and pruning would have reduced gross income by about $4800 per acre so far in this trial, including pruning costs and lower cumulative yield.
- Pruning tends to reduce yields more on widely spaced trees.
- 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.
- Cumulative Carmel yields are significantly higher on closely planted trees but there is no obvious yield advantage to close planting of the larger Nonpareil variety.
- Unpruned trees had fewer mummies (unharvested nuts) than annually pruned trees.
- Widely spaced trees had 2.5 times more mummies per acre than closely planted trees.
- Hansen hybrid rootstock is not well suited for the poorly drained soils of the Sierra foothills.

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

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