

Integration of Tree Density & Minimal Pruning for Efficient Almond Production

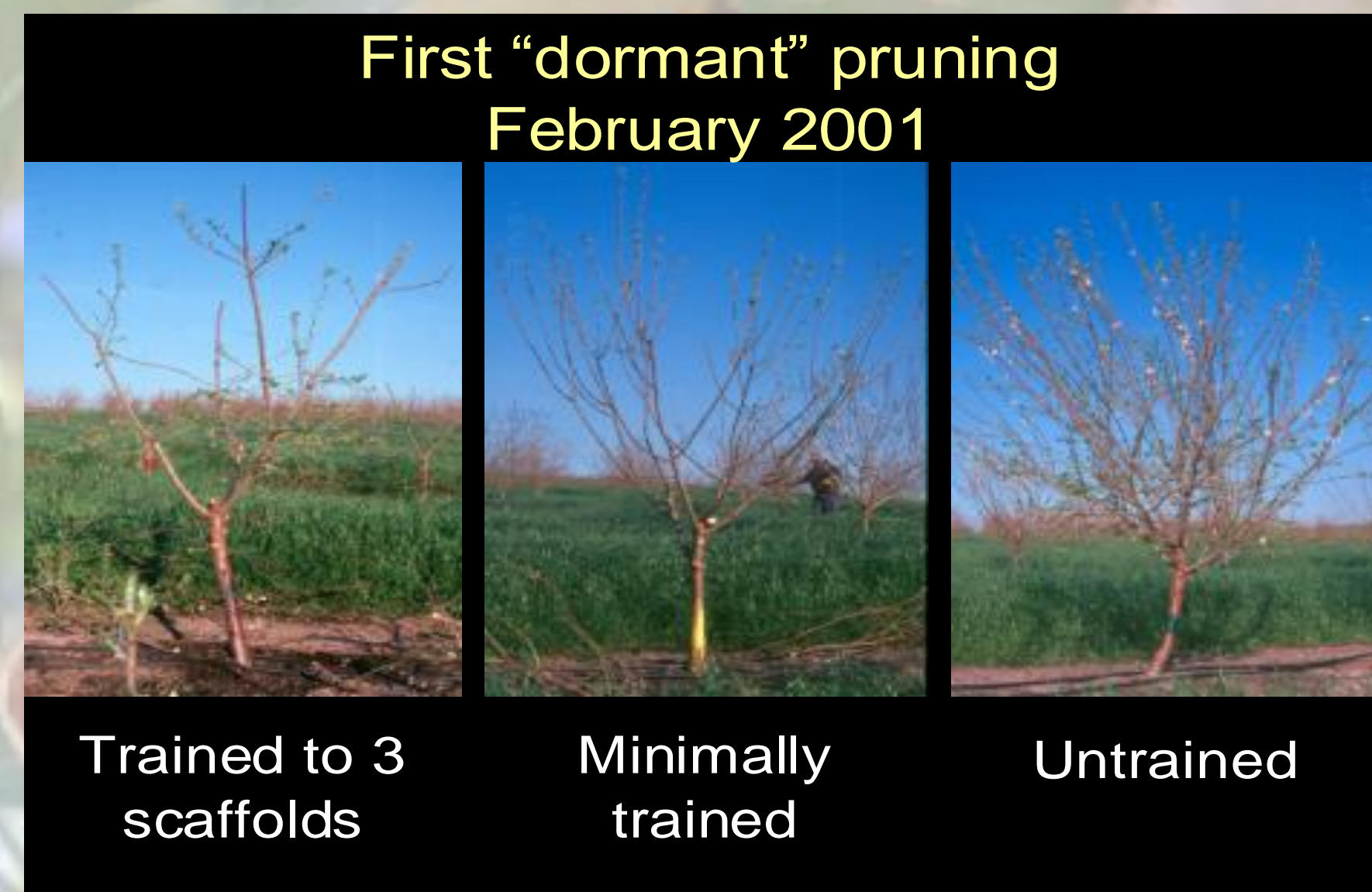
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Objectives:

- 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 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.

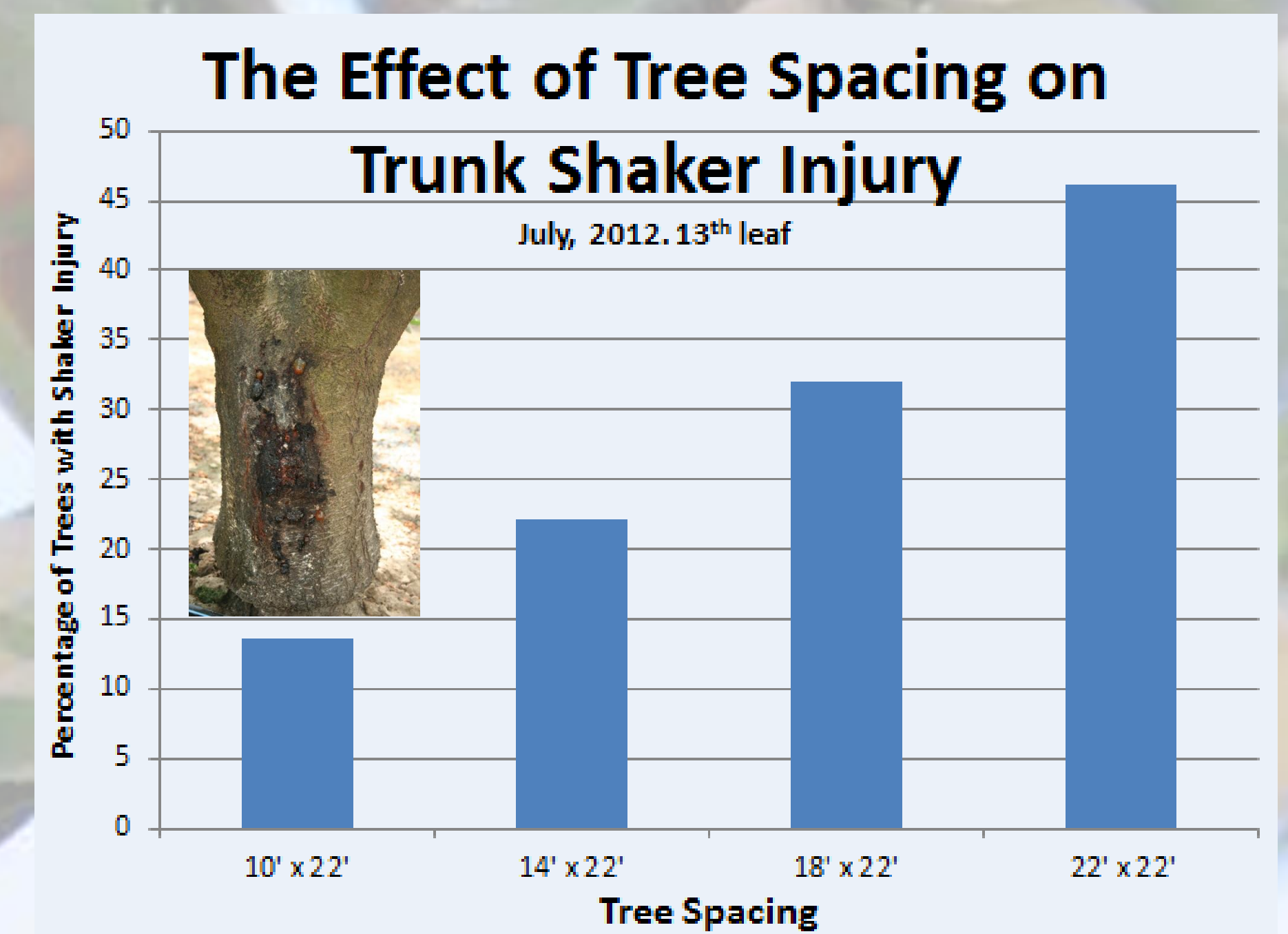
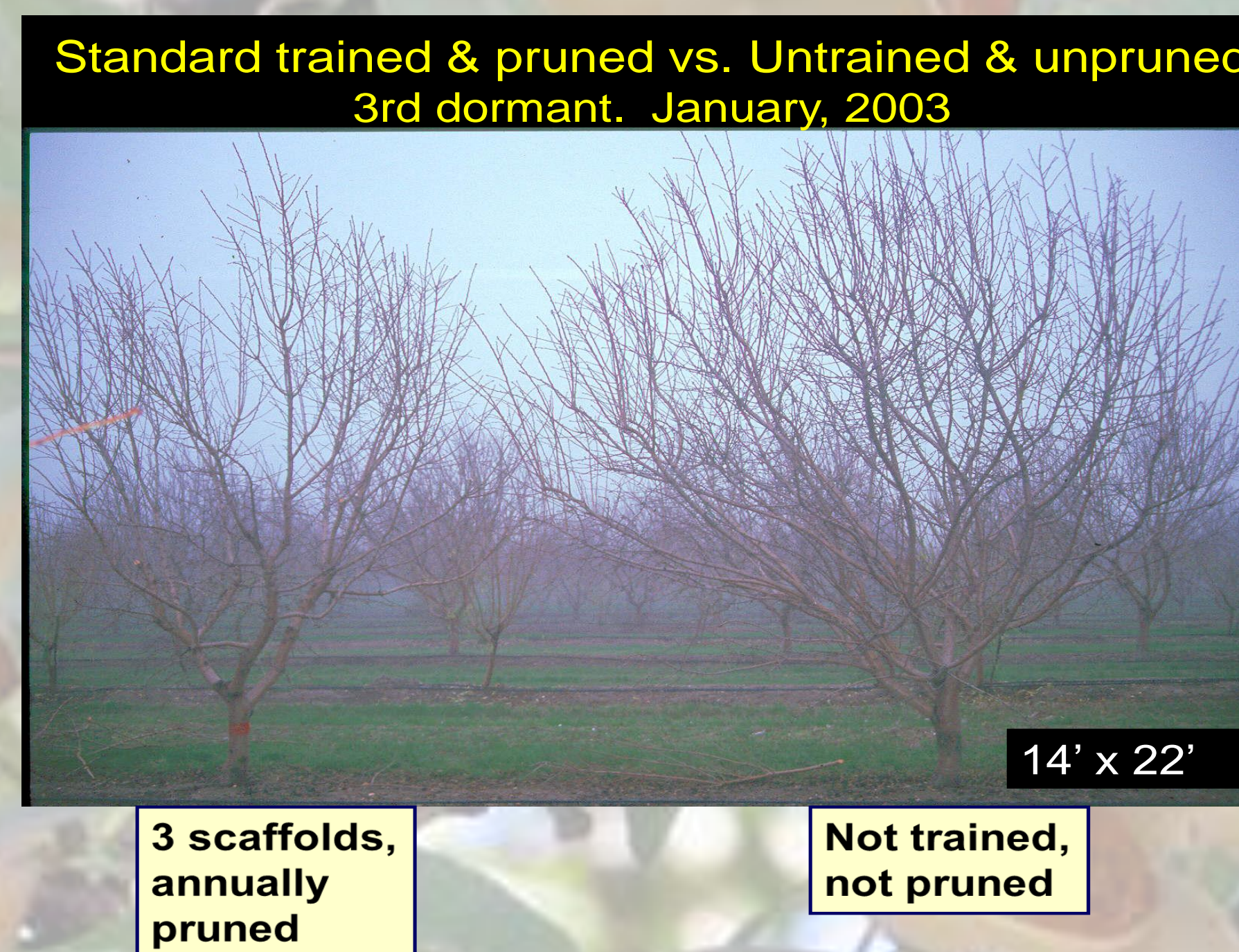
Multifactorial Trial:

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

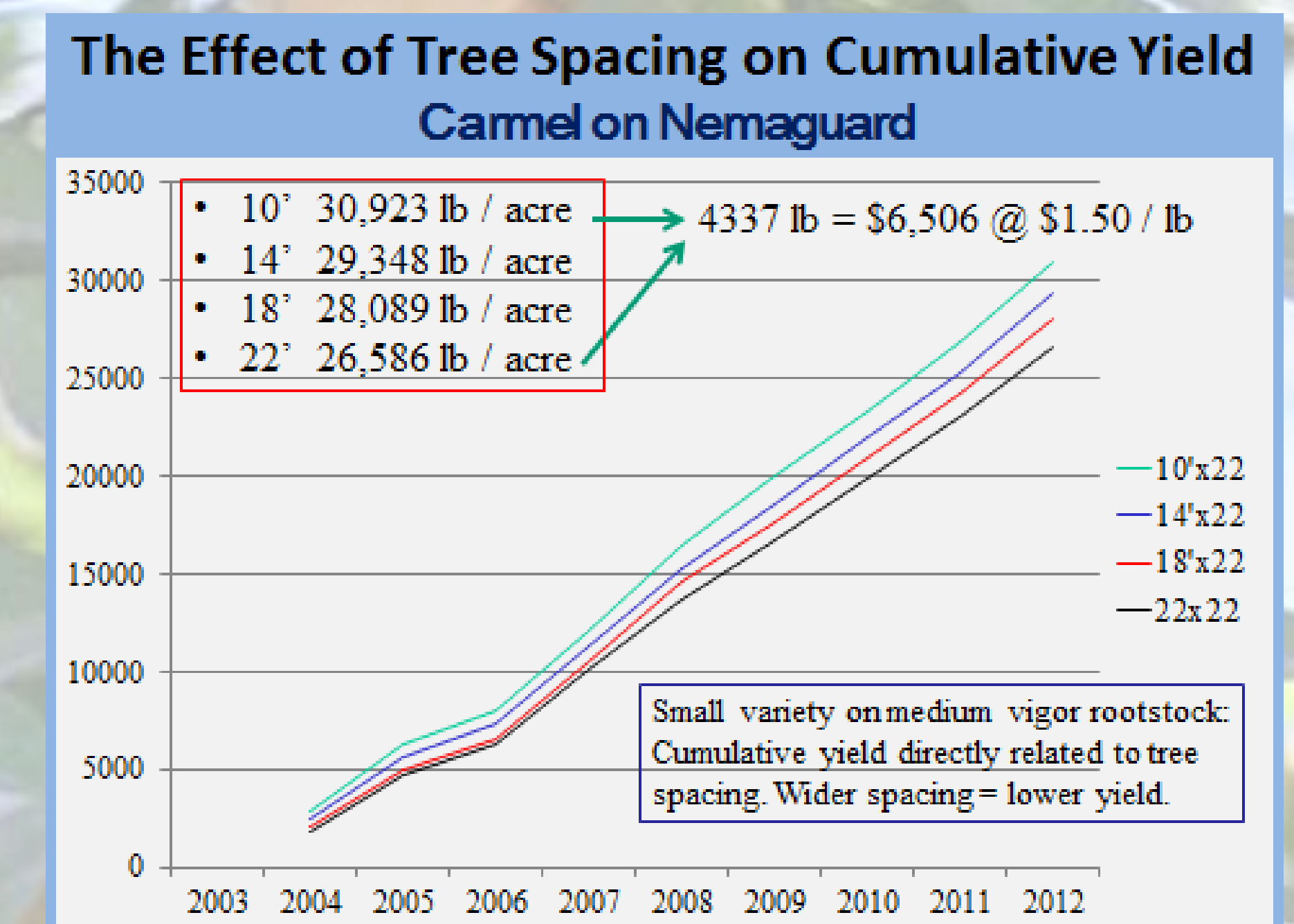


Pruning Strategies:

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



Conclusions after the first 13 years:

Scaffold Selection (Training) & Pruning:

- In most years Nonpareil yields are statistically similar in conventionally pruned, minimally pruned and nonpruned trees while Carmel yields are higher in unpruned trees.
- Cumulatively, unpruned Nonpareil trees have yielded 1345 pounds more than conventionally trained & pruned trees.
- Cumulatively, untrained & unpruned Carmel trees have accumulated 3216 pounds more than conventionally pruned trees through the 13th leaf.
- At \$1.50 / pound, conventional training and pruning would have reduced gross income by about \$6800 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.
- 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 potentially reducing overwintering of navel orangeworm) and have suffered less trunk injury during mechanical harvest.

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

The Effects of Pruning, Tree Spacing & Rootstock on Current (13th Leaf) & Cumulative Yield

	Nonpareil		Carmel	
	2012 Yield (lb/acre)	Cumulative	2012 Yield (lb / acre)	Cumulative
Training & Pruning				
Trained to 3 scaffolds; Annual, moderate pruning	4209 ab	29,338	3126 b	25,620
Trained to 3 scaffolds; unpruned after 2 nd year	4387 a	30,670	3508 ab	27,535
Trained to multiple scaffolds; Three annual pruning cuts	3979 b	28,769	3308 ab	27,080
No scaffold selection; no annual pruning	4220 ab	30,683	3685 a	28,836
Tree Spacing				
10' x 22'	4228 a	29,871	3436 a	28,324
14' x 22'	4148 a	30,400	3454 a	28,234
18' x 22'	4334 a	30,128	3528 a	26,876
22' x 22'	4083 a	29,059	3208 a	25,637
Rootstock				
Hansen	4470 a	29,534	2922 b	25,141
Nemaguard	3927 b	30,195	3891 a	29,394