North San Joaquin Valley Almond Day

Sponsored by UC Cooperative Extension

Coffee, donuts & snacks provided by:

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Almond Tree Pruning by the Numbers

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•Almond growing is a business, not a hobby or a beauty contest

• Pruning should be a science, not an art

•If and when we prune, we need to know why we are pruning - prune for a purpose

•Why am I spending the money to prune - is it going to make me money or prevent me from losing it?

Two Phases of Pruning Almond Trees

1. Tree Training Phase
   - Establish permanent framework of the tree
   - Primary & secondary scaffold selection
   - Years 1 – 3

2. Maintenance Pruning Phase
   - Maintaining shape of the tree
   - Years 4 - 25

Why Prune Almond Trees?

- Training Phase
  - Scaffold selection to improve structural integrity of the tree (prevent limb breakage)
  - Establish shape of the tree (try to make upright varieties like Padre, Mission, Aldrich more open)
  - Allow access for shakers (including limb shaking) and other equipment
  - Establish tree shape for a long and productive life

Why Prune Almond Trees?

- Maintenance Phase
  - Manage light distribution through the tree to maximize life of fruiting spurs, maintain lower wood (prevent shade out)
  - Invigorate and renew fruitwood
  - Reduce alternate bearing
  - Control tree size (height) to improve nut removal and spray coverage

Why Prune Almond Trees?

- Maintenance pruning continued
  - Allow equipment access (shakers, weed sprayers, harvest equipment, etc.)
  - Safety for tractor driver
  - Reduce disease (Alternaria, hull rot, rust, etc.)
  - Sunlight on orchard floor to improve drying
  - Remove dead or diseased limbs
  - Reduce sticks at harvest

Orchard Management Principle:

- We are farming sunlight.
- Trees need to fill all the available space in an orchard in order to capture maximum sunlight and produce maximum yields
- The sooner this is achieved, the sooner an orchard will obtain maximum yields
- Don’t want to sacrifice long-term viability (profitability) of an orchard by prematurely declining trees from shade out

Discuss Results of Four University Pruning Trials

- “Old” Nickels Estate Trial. 1979 – 1999
- New Nickels Estate Trial. 1997 - ?
- Kern County Trial (Paramount Farms). 1996 - ?
- Stanislaus County Trial 2000 - ?

“Old” Minimum Pruning Trial Nickels Estate. 1979 - 1999

Spacing = 7’ x 22’

1. Three scaffolds, annually pruned
2. Three scaffolds, unpruned after first dormant
3. Two scaffolds (“V” shaped), annually pruned
4. Temporary hedge row
   - Every other tree slowly pruned back each year, completely removed in 8th leaf
   - Remaining trees had 3 scaffolds and were pruned annually

Yields in Long-term Almond Pruning Trial

Spacing = 7’ x 22’. John Edstrom, et. al., Nickels Estate (1984 – 1999)

	18th leaf	19th leaf	20th leaf	21st leaf	Cumulative Yield
Annually pruned	2624	2498 a	2494 a	2136	34,176
Unpruned	2833	2680 a	1958 ab	2307	35,082
2 scaffolds	2968	2953 a	2296 a	2483	36,820
Temporary trees removed	2076	2081 b	1757 b	1662	27,861

Yields in Long-term Almond Pruning Trial

Spacing = 7’ x 22’. John Edstrom, et. al., Nickels Estate (1984 – 1999)

	Pruning Costs	Gross Profit / acre	Net Profit
Annually pruned	$3675	$51,264	$47,589
Unpruned	$175	$52,623	$52,448
2 scaffolds	$3675 +	$55,230	$51,555
Temporary trees removed	?	$41,792	?

Pruning costs @ $175 per acre, including stacking & shredding

Almond price of $1.50 / pound

Nickels Estate Pruning Trial

Unpruned trees ~ 20th leaf

- Lower wood shaded out
- Crop at top of canopy

Lessons Learned from "Old" Nickels Trial

- Yield in "unpruned" trees did not decline for at least 21 years
- Normal annual pruning may have reduced profits
- Complicated pruning systems may not increase profits
- Removing temporary trees is a bad idea

Do Results of "Old" Nickels Estate Trial Apply to a "Good" San Joaquin Valley Orchard??

- Orchard was in class III soil
- Planted at 7' x 22' – not typical
- Sacramento Valley growing conditions
- One orchard, in one location, under one set of farming conditions

“New” Minimum Pruning Trial Nickels Estate.

Spacing = 16’ x 22’, sandy loam soil, slip plowed, microsprinklers, good fertility

1. Three scaffolds, annually pruned
2. Three scaffolds, “unpruned” after 1rst year
3. Machine topped:
   - same as unpruned but mechanically topped in 2nd & 4th dormant period; unpruned since 4th-leaf
4. Temporary Scaffolds:
   - Maintain permanent 3 scaffolds
   - Gradually remove temporary scaffolds in years 5 - 8

Cumulative Yields of "New" Nickels Estate Minimum Pruning Trial.

Through 11th leaf (2007)

	Nonpareil	Monterey	Carmel	Aldrich
Standard Annual	16,390	15,951	15,230	17,073
Unpruned	17,243	18,576	13,281	16,396
Topped	16,406	15,608	16,414	16,782
Temp scaffolds	16,747	16,217	15,567	--

Lessons Learned From "New" Nickels Estate Pruning Trial

- "Unpruned" trees and temporary scaffold trees out yield standard pruned trees in early years
- Temporary scaffold pruning is expensive and not economically feasible
- Temporary scaffold pruning does not work at all with Aldrich
- Production between all pruning treatments were the same after 6th - leaf

Lessons Learned From "New" Nickels Estate Pruning Trial, cont.

- Cumulative cost savings of $500 - $800 per acre through 11th leaf in unpruned system
- No increase in disease in unpruned trees
- No increase in stick tights in unpruned trees
- Tree height appears shorter in unpruned trees
- Are some varieties better suited for minimal pruning?

Kern County Pruning Trial
Paramount Farms. 1996 - 2006

Spacing = 24’ x 21’; Class I Wasco Sandy Loam

1. Dormant pruned every year
2. Dormant pruned every other year
3. Mechanically topped & hedged every year
4. Mechanically topped & hedged every other year
5. Mechanically topped & hedged and hand pruned every year
6. No scaffold selection, no pruning

Standard Annual Pruning

“Unpruned”

Mechanically Topped & Hedged Annually

Mechanically Topped & Hedged Alternate Years

Cumulative Yields – Kern County through 11th leaf

Pounds per acre

	Nonpareil	Carmel	Monterey
Annual pruning	19,245	21,698	20,841
Pruned every other year	20,585	20,363	21,313
Topped & hedged annually	20,667	22,771	22,153
Mechanical alternate years	20,088	22,561	20,831
Mechanical + hand pruned	18,643	20,248	20,096
Unpruned	21,536	23,577	21,843

Lessons Learned From Kern County Pruning Trial

- Pruning makes very little difference in yield (through 11th leaf) for all varieties
- In general, annual pruning has the lowest yields while unpruned trees have the highest yields
- Unpruned trees did not have more stick tights
- Unpruned trees are shorter than annually hand pruned trees

Stanislaus County Pruning Trial

- Planted fall, 1999
- Very vigorous orchard in development years
- Four spacings (10 x 22, 14 x 22, 18 x 22, 22 x 22)
- Four pruning strategies

1) Standard trained, standard annual pruning

- 3 scaffolds
- medium annual pruning to maintain open centers

2) Standard trained, unpruned

- 3 scaffolds
- unpruned after second dormant season

3) Minimal training & pruning

- 4-6 scaffolds
- maximum of 3 cuts each dormant pruning thereafter

4) Untrained, unpruned

- no scaffold selection
- no annual pruning*

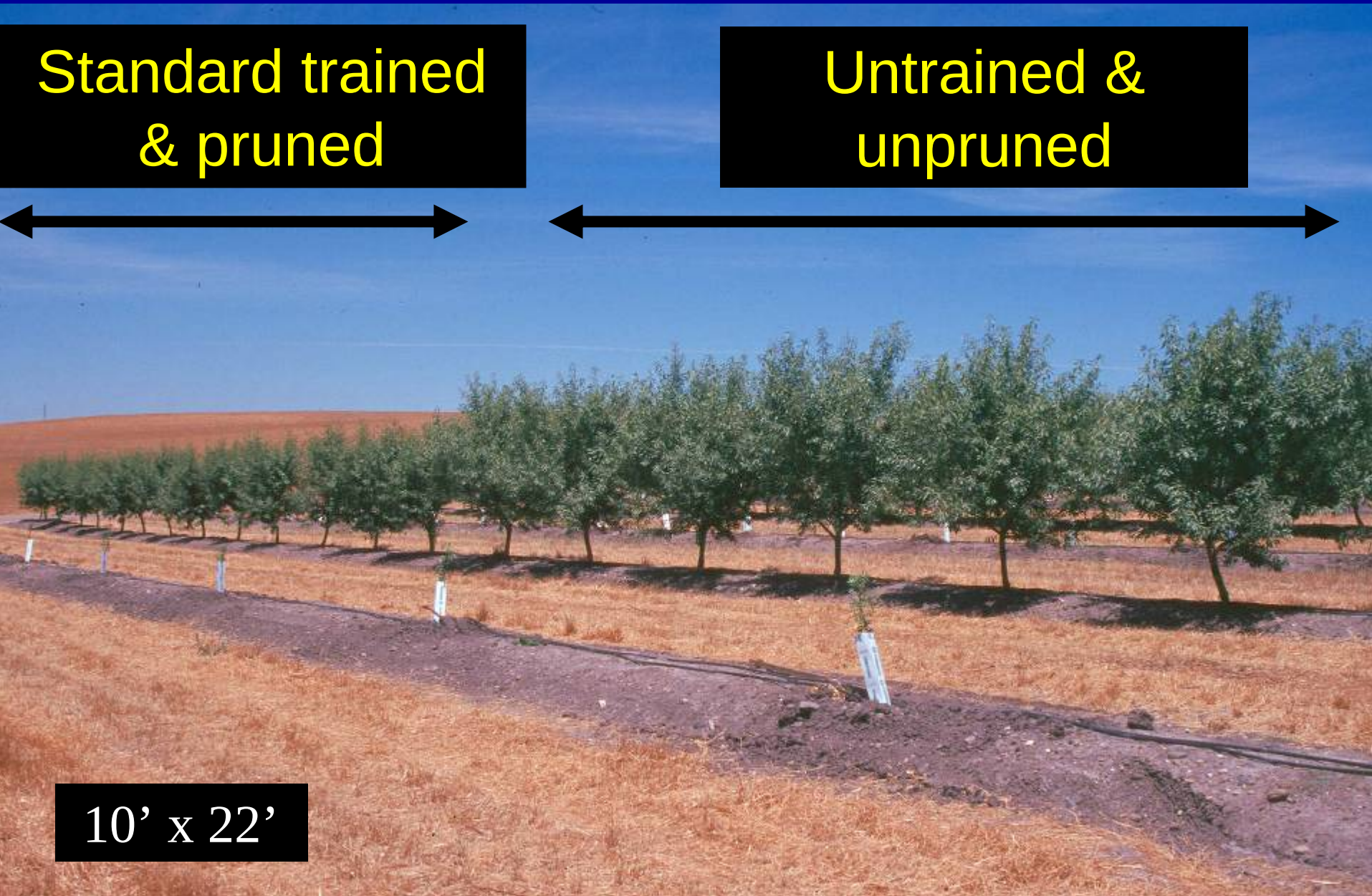
First “dormant” pruning
February 2001

Trained to 3 scaffolds

Minimally trained

Untrained

2nd-leaf. May, 2001



Second “dormant” pruning
March 2002

Standard trained,
pruned annually

Minimally trained,
minimally pruned

Untrained,
unpruned

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

Standard Trained, Annually Pruned Nonpareil. 7th Leaf

Standard Trained, Unpruned five years – 7th leaf

Untrained / unpruned Nonpareil. 7th Leaf.

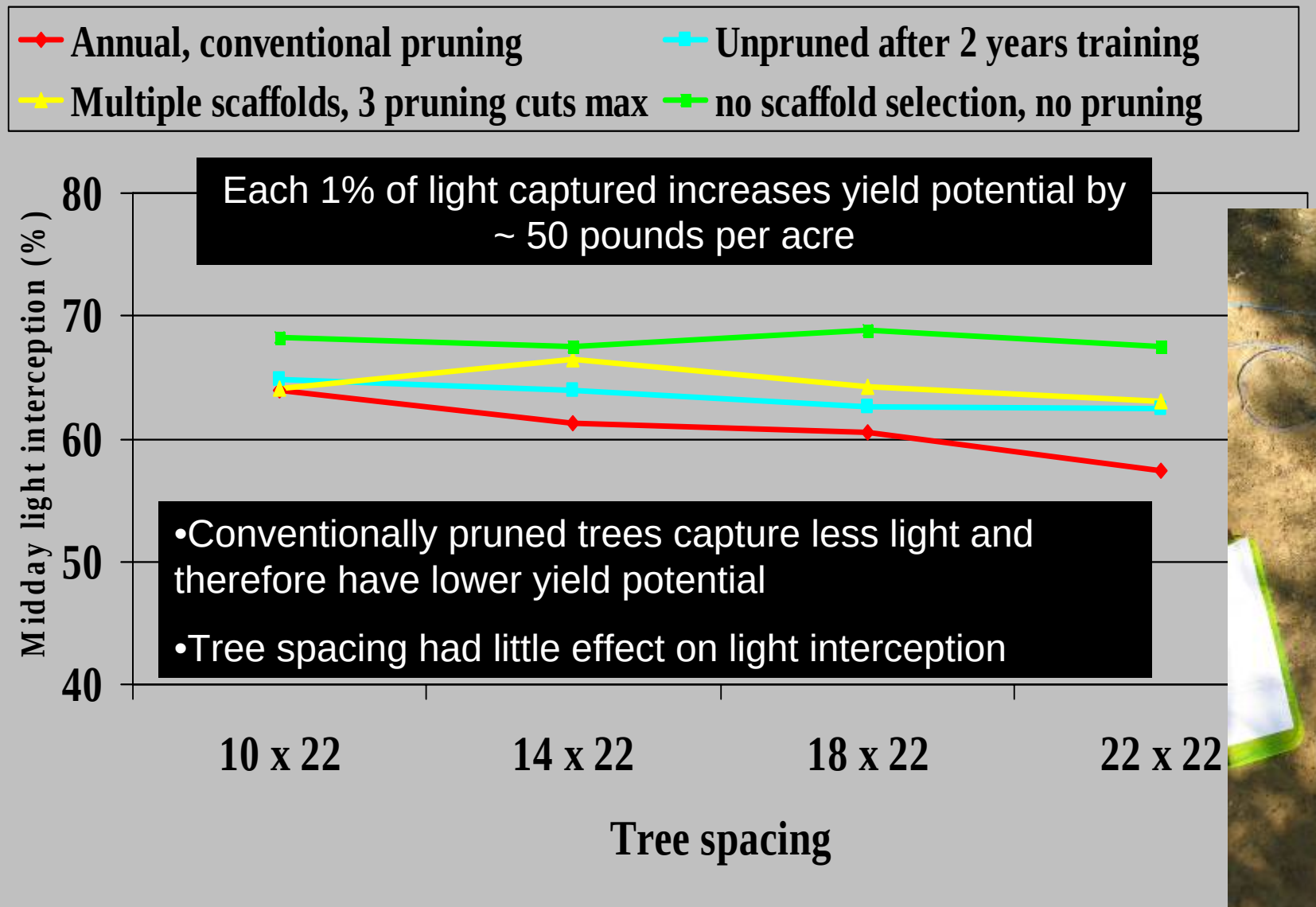
Difference in shaded ground area

Spacing = 22’ x 22’

Trained, annually pruned

Untrained, unpruned

The Effect of Tree Spacing and Pruning on Midday Light Interception



Influence of Training and Pruning on Cumulative Yield of Nonpareil thru 8th leaf

	4th leaf	5th leaf	7th leaf	8th leaf	Cum. yield	Diff. to conv.
Conv. Pruning	2112	2321	3108	4020	11,561	--
3 scaffolds, delayed non-pruning	2336	2460	3547	4172	12,515	+ **954**
Minimally trained & pruned	2474	2348	2947	4047	11,817	**+256**
No training or pruning	2420	2413	3371	4151	12,355	**+794**

Influence of Training and Pruning on Cumulative Yield of Carmel thru 7th leaf

	4th leaf	5th leaf	6th leaf	7th leaf	Cum. yield	Diff. to conv.
Conventional Pruning	2046	2818	1524	3533	9,921	--
3 scaffolds, delayed non-pruning	1991	3088	1854	3859	10,792	+ **871**
Minimally trained & pruned	2322	3088	1820	3713	10,943	+ **1022**
No training or pruning	2384	3358	1962	3888	11,592	+ **1671**

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Gross profit increase ~ $4150 / acre = $166,000 on 40 acres

The Effect of Pruning on Scaffold Splitting Fifth-leaf

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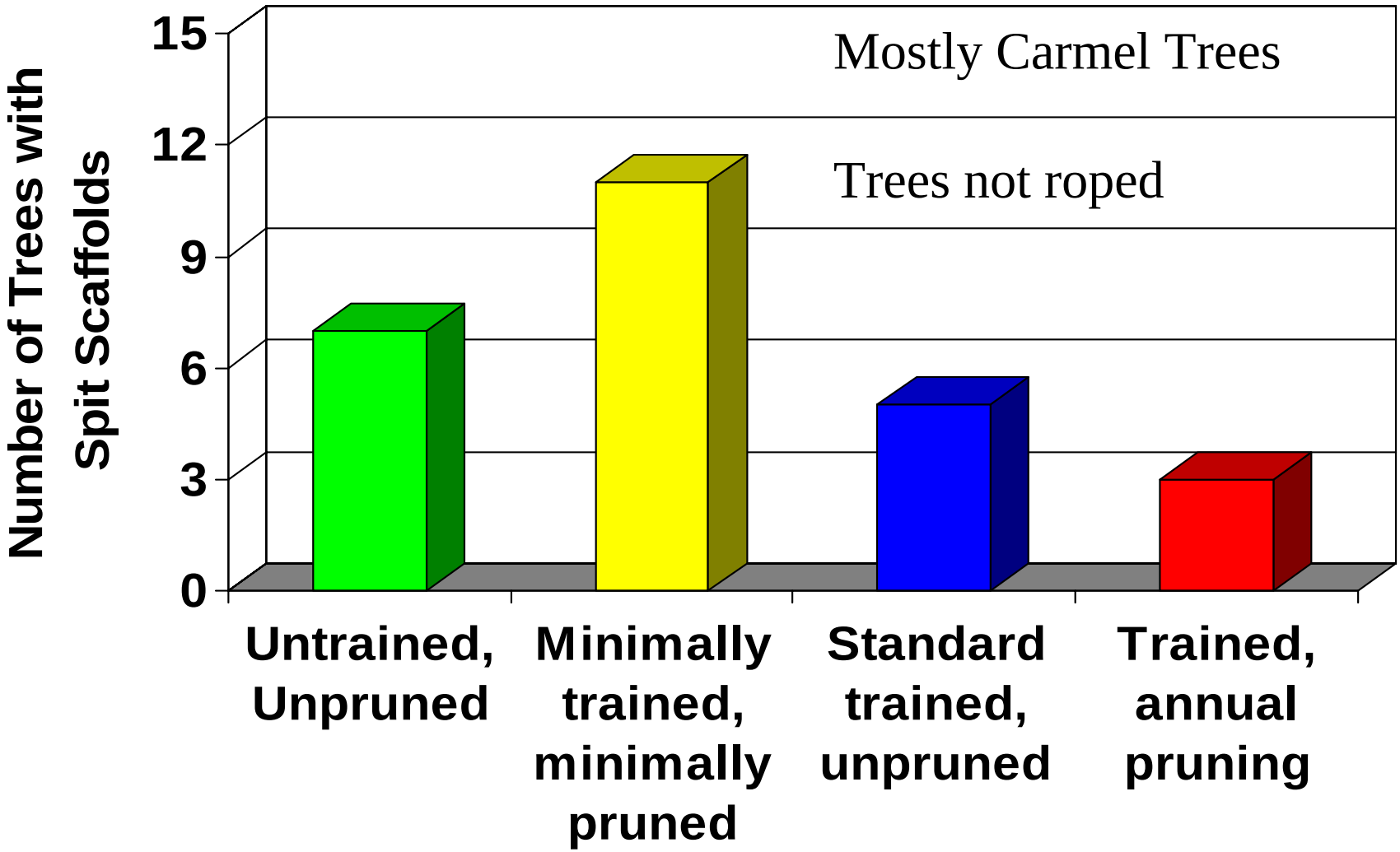
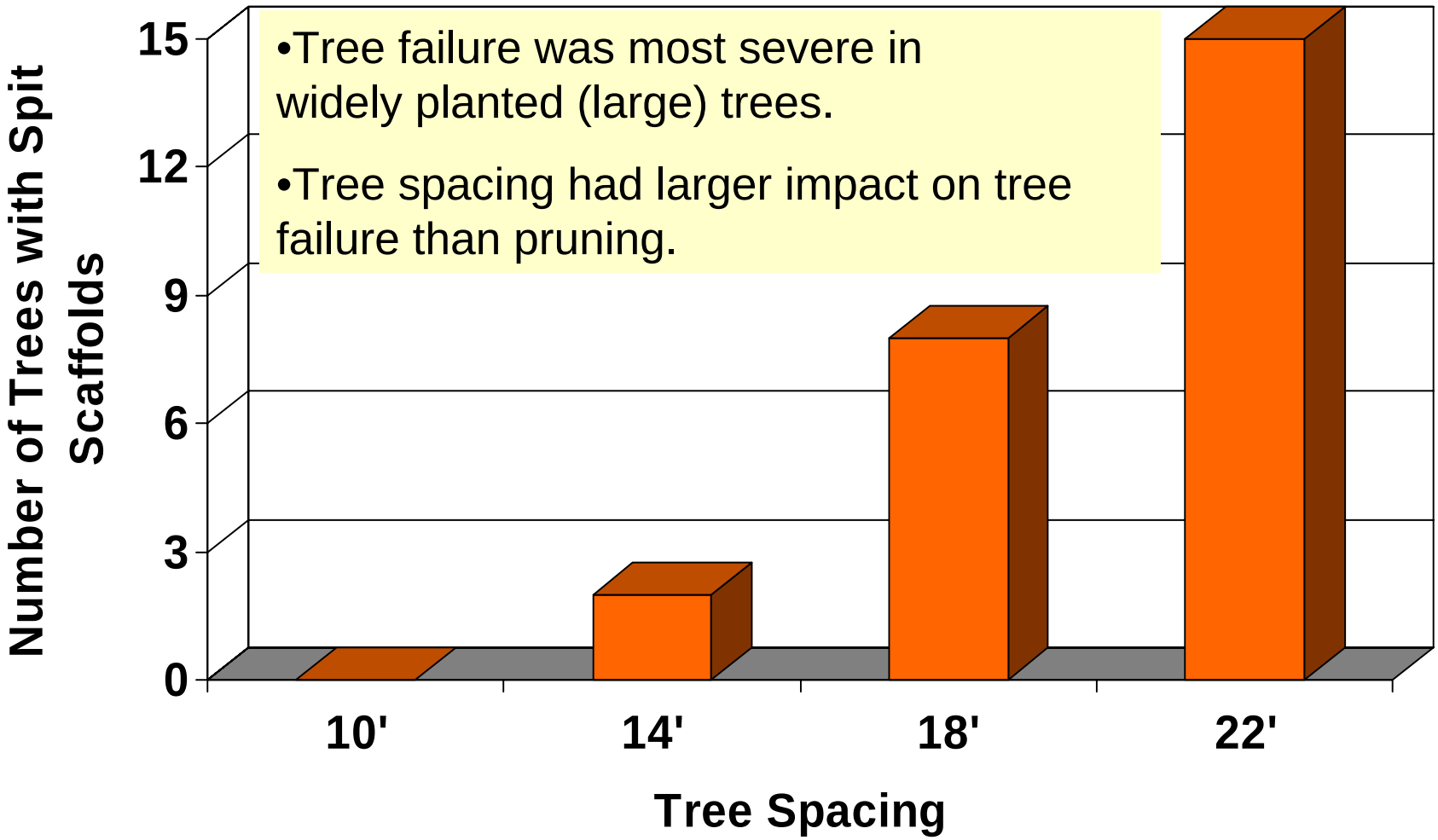


The Effect of Tree Spacing on Scaffold Splitting of Almond Trees

Fifth-leaf



The Effect of Pruning on Hull Rot of Nonpareil Almond

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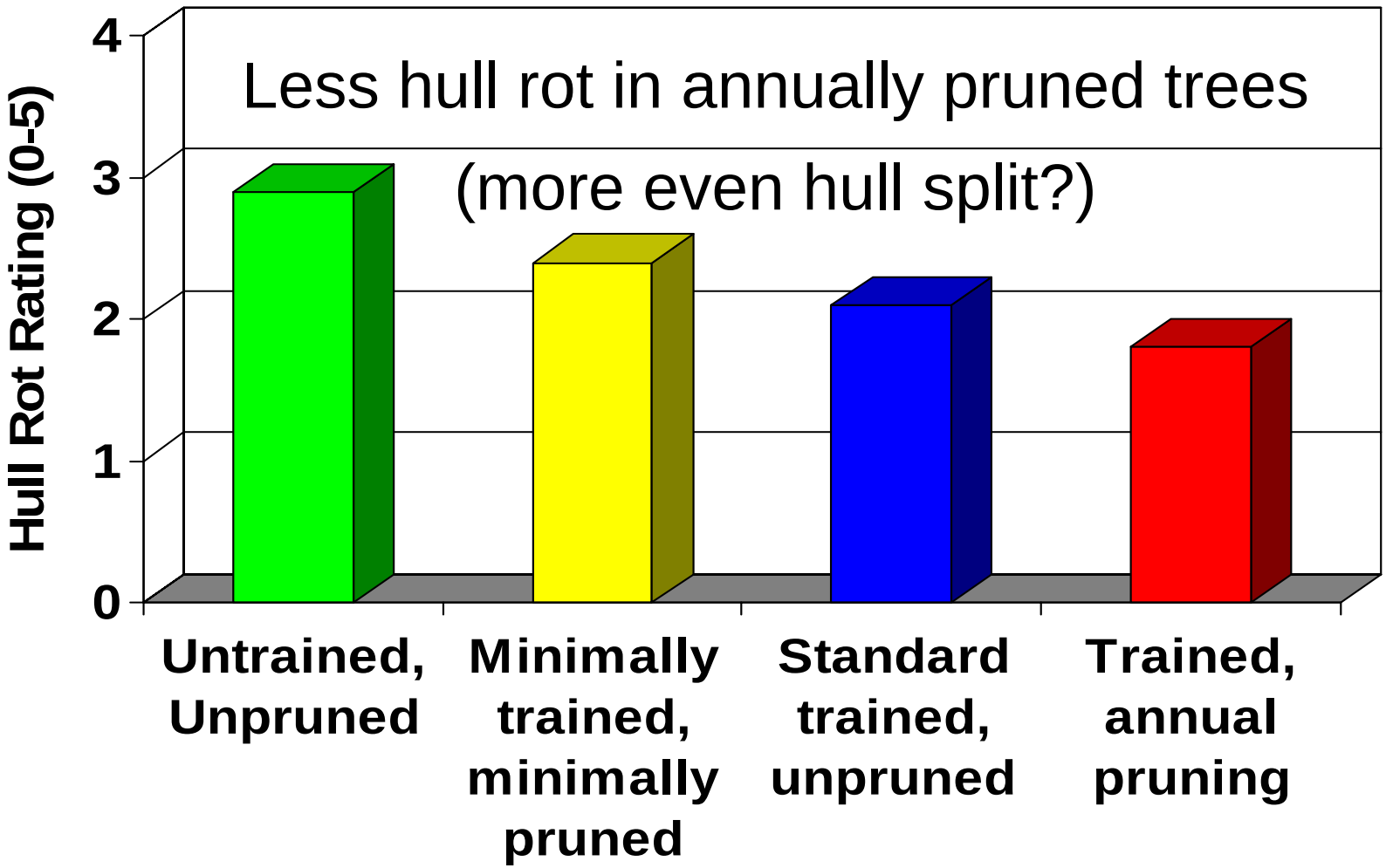

Early Conclusions, Stanislaus County Trial:

- Pruning has not increased yield. Conventional annual pruning has reduced yield in most years so far.

- Unpruned Carmel trees have grossed $4150 more per acre than conventionally trained and pruned trees (including yield increase and reduced pruning costs)

Early Conclusions, Stanislaus County Trial:

- Trees trained to more than three scaffolds are more prone to scaffold breakage – need to rope them
- Scaffold selection (training) is less important in closely planted trees
  - Trees stay smaller, less weight on each limb
  - May not need to limb shake
- More hull rot in unpruned trees. No difference observed in other diseases.
- No difference observed in stick tights.

Why Prune Almond Trees?

- Manage light distribution through the tree to maximize life of fruiting spurs, maintain lower wood (prevent shade out)
- Invigorate and renew fruitwood
- Reduce alternate bearing
- Control tree size (height) to improve nut removal and spray coverage

Why Prune Almond Trees?

Many stated reasons about maintaining yield and tree size may not be true

- ~~Manage light distribution through the tree to maximize life of fruiting spurs, maintain lower wood (prevent shade out)~~
- ~~Invigorate and renew fruitwood~~
- Reduce alternate bearing
- ~~Control tree size (height) to improve nut removal and spray coverage~~

Why Prune Almond Trees?

There are real reasons to prune

- Allow equipment access (shakers, weed sprayer, etc.
- Safety for tractor driver
- Reduce disease (Alternaria, hull rot, rust, etc.)
- Sunlight on orchard floor to improve drying
- Remove dead or diseased limbs
- Reduce sticks at harvest

Things to Consider if You Want to Try a Minimum Pruning System

- Consider starting with three primary scaffolds properly placed
- Leave scaffolds as long as possible
  - Must be stiff enough not to “flop”
- Don’t worry about small side shoots if less than 1/3 diameter of scaffold
- The idea is to leave as much wood as possible to avoid stimulating rank growth

Good

Better?

Bad

Excessive pruning will lead to excessive water sprout growth which will need to be removed

More Bad Training

Scaffolds too flat and not spaced well vertically

Scaffolds not spaced well vertically

Gum in Crotch of Tree

Gum is a Result of Crack at Base of Limb

Improper vertical spacing of scaffolds leads to weak limb attachment and scaffold breakage

If you decide not to select scaffolds…

- Head tree extra high at planting time (minimum of 40 inches)
- Maybe not head trees at all??
- First dormant pruning: prune off all limbs that will interfere with shaker
- Be strong! Stay the course. Ignore the laughter

Untrained / unpruned Nonpareil. 7th Leaf.

- Minimally trained trees should be <u>loosely</u> tied after second dormant pruning to prevent scaffold breakage

In Summary

- Any yield advantage to pruning will be very long term and must make up for short term losses (in yield and increased expenses).
  - Can certainly stop pruning at some point
  - At 20th leaf? 10th leaf? 2nd leaf? Never prune??

- Current pruning trials must be monitored for many more years to determine long-term effects on yield, disease, and overall profitability.

Bottom Line:

There are many reasons to prune, yield is probably not one of them

Thank you for your attention