Canopy Management

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9th Advances in PISTACHIO PRODUCTION

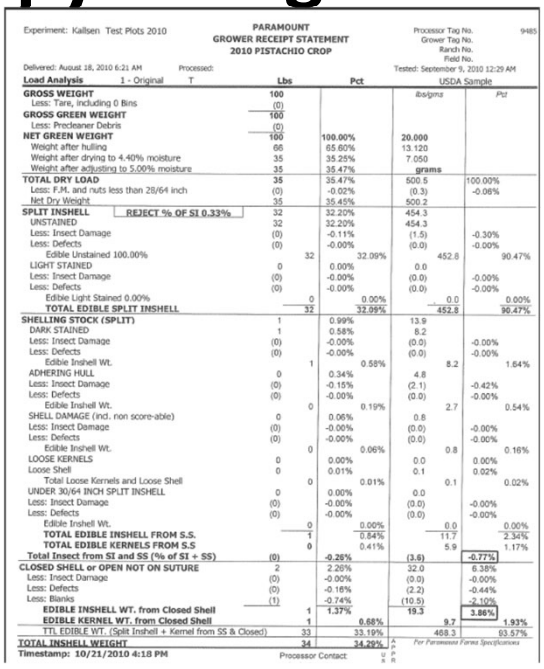
November 9th 2020

Canopy Management

- What
- Why
- When
- How (and who)
  - Hand
  - Mechanical
- Economics
  - Hand
  - Mechanical

Canopy Management: What

- What is Canopy Management?
  - mature tree pruning: 6-8 -> lifespan
- Decisions to achieve desired canopy configuration:
  - Height
  - Volume
  - Accessible trunk
  - Branch and shoot orientation
  - Light penetration
  - Net Profit



Experiment: Kallsen Test Plots 2010

PARAMOUNT
GROWER RECEIPT STATEMENT
2010 PISTACHIO CROP

Processor Tag No. 9485
Grower Tag No.
Ranch No.
Field No.

Delivered: August 18, 2010 6:21 AM
Processed:
Tested: September 9, 2010 12:29 AM

Load Analysis 1 - Original T	Lbs	Pct	USDA Sample lbs/gms	Pct
GROSS WEIGHT	100			
Less: Tare, including 0 Bins	(0)			
GROSS GREEN WEIGHT	100			
Less: Precleaner Debris	(0)			
NET GREEN WEIGHT	100	100.00%	20.000	
Weight after hulling	66	65.60%	13.120	
Weight after drying to 4.40% moisture	35	35.25%	7.050	
Weight after adjusting to 5.00% moisture	35	35.47%	grams	
TOTAL DRY LOAD	35	35.47%	500.5	100.00%
Less: P,M, and nuts less than 28/64 inch	(0)	-0.02%	(0.3)	-0.06%
Net Dry Weight	35	35.45%	500.2	
SPLIT INSHELL REJECT % OF SI 0.33%	32	32.20%	454.3	
UNSTAINED	32	32.20%	454.3	
Less: Insect Damage	(0)	-0.11%	(1.5)	-0.30%
Less: Defects	(0)	-0.00%	(0.0)	-0.00%
Edible Unstained 100.00%	32	32.09%	452.8	90.47%
LIGHT STAINED	0	0.00%	0.0	
Less: Insect Damage	(0)	-0.00%	(0.0)	-0.00%
Less: Defects	(0)	-0.00%	(0.0)	-0.00%
Edible Light Stained 0.00%	0	0.00%	0.0	0.00%
TOTAL EDIBLE SPLIT INSHELL	32	32.09%	452.8	90.47%
SHELLING STOCK (SPLIT)	1	0.99%	13.9	
DARK STAINED	1	0.58%	8.2	
Less: Insect Damage	(0)	-0.00%	(0.0)	-0.00%
Less: Defects	(0)	-0.00%	(0.0)	-0.00%
Edible Inshell Wt.	1	0.58%	8.2	1.64%
ADHERING HULL	0	0.34%	4.8	
Less: Insect Damage	(0)	-0.15%	(2.1)	-0.42%
Less: Defects	(0)	-0.00%	(0.0)	-0.00%
Edible Inshell Wt.	0	0.19%	2.7	0.54%
SHELL DAMAGE (incl. non score-able)	0	0.06%	0.8	
Less: Insect Damage	(0)	-0.00%	(0.0)	-0.00%
Less: Defects	(0)	-0.00%	(0.0)	-0.00%
Edible Inshell Wt.	0	0.06%	0.8	0.16%
LOOSE KERNELS	0	0.00%	0.0	0.00%
Loose Shell	0	0.01%	0.1	0.02%
Total Loose Kernels and Loose Shell	0	0.01%	0.1	0.02%
UNDER 30/64 INCH SPLIT INSHELL	0	0.00%	0.0	
Less: Insect Damage	(0)	-0.00%	(0.0)	-0.00%
Less: Defects	(0)	-0.00%	(0.0)	-0.00%
Edible Inshell Wt.	0	0.00%	0.0	0.00%
TOTAL EDIBLE INSHELL FROM S.S.	1	0.84%	11.7	2.34%
TOTAL EDIBLE KERNELS FROM S.S	0	0.41%	5.9	1.17%
Total Insect from SI and SS (% of SI + SS)	(0)	-0.26%	(3.6)	-0.77%
CLOSED SHELL or OPEN NOT ON SUTURE	2	2.26%	32.0	6.36%
Less: Insect Damage	(0)	-0.00%	(0.0)	-0.00%
Less: Defects	(0)	-0.16%	(2.2)	-0.44%
Less: Blanks	(1)	-0.74%	(10.5)	-2.10%
EDIBLE INSHELL WT. from Closed Shell	1	1.37%	19.3	3.86%
EDIBLE KERNEL WT. from Closed Shell	1	0.68%	9.7	1.93%
TTL EDIBLE WT. (Split Inshell + Kernel from SS & Closed)	33	33.19%	468.3	93.57%
TOTAL INSHELL WEIGHT	34	34.29%		

Timestamp: 10/21/2010 4:18 PM
Processor Contact:

Per Paramount Farms Specifications

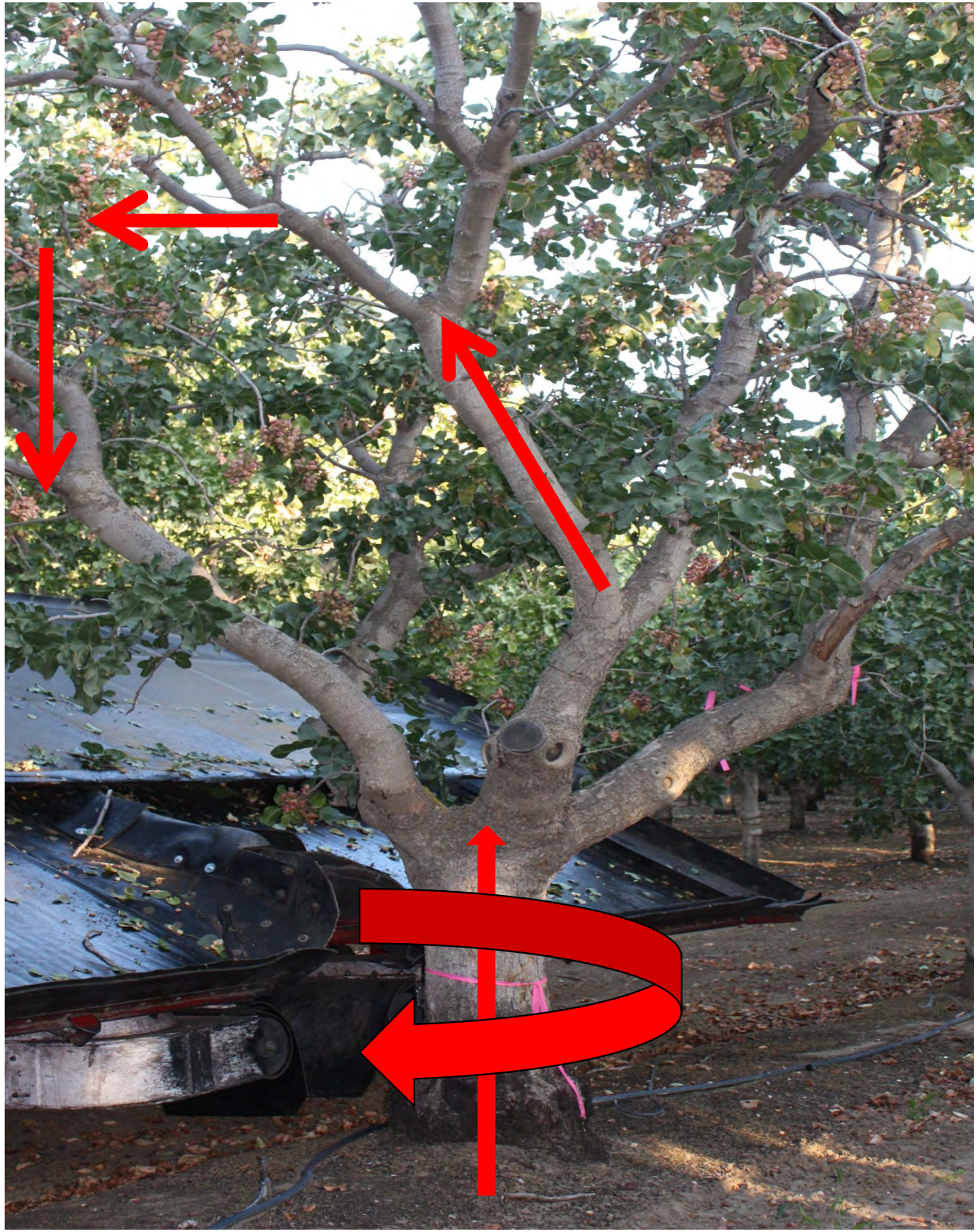
Canopy Management: Why

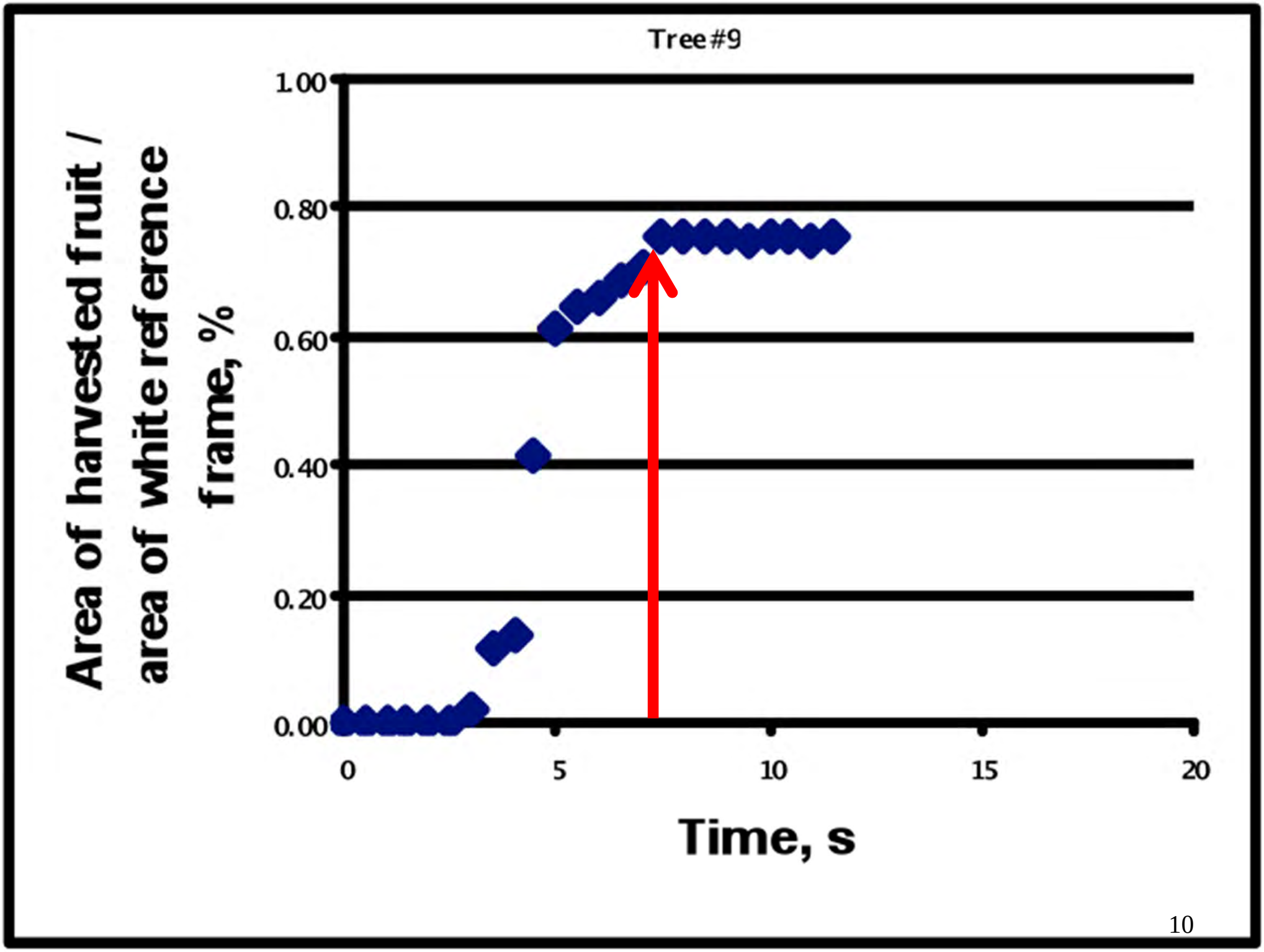
- Why prune a mature tree:
  - Orchard operations
    - Spraying
    - Harvesting
  - Ensuring good annual crops
    - Light Interception
      - 80% of the orchard floor
    - Light penetration into the canopy
    - Branching
      - More bearing points
    - Annual yields
      - Alternate bearing

Canopy Management: Why

- Why prune a mature tree?
  - Orchard operations:
    - Spraying
    - Harvesting


POM




Tree #9
Area of harvested fruit / area of white reference frame, %
1.00
0.80
0.60
0.40
0.20
0.00
0
5
10
15
20
Time, s

Canopy Structure: Harvest

- Compact and upright
- accessible trunk
- Scaffolds:
  - Upright
  - Short
  - Stiff
- Canopy thinned
  - No damping

Canopy Management: Why

- Why prune a mature tree ?
  - Ensuring good annual crops:
    - Light Interception
      - 80% of the orchard floor
    - Light penetration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Canopy Management: Why

- Why prune a mature tree?
- Branching:
  - More leaves
  - More bearing points: buds
    - Components of yield:
      - More buds = clusters
      - More nuts
      - Bigger nuts

Canopy Management

- **Why prune a mature tree?**
- **Control Alternate Bearing**

Mechanical topping mitigated alternate bearing:

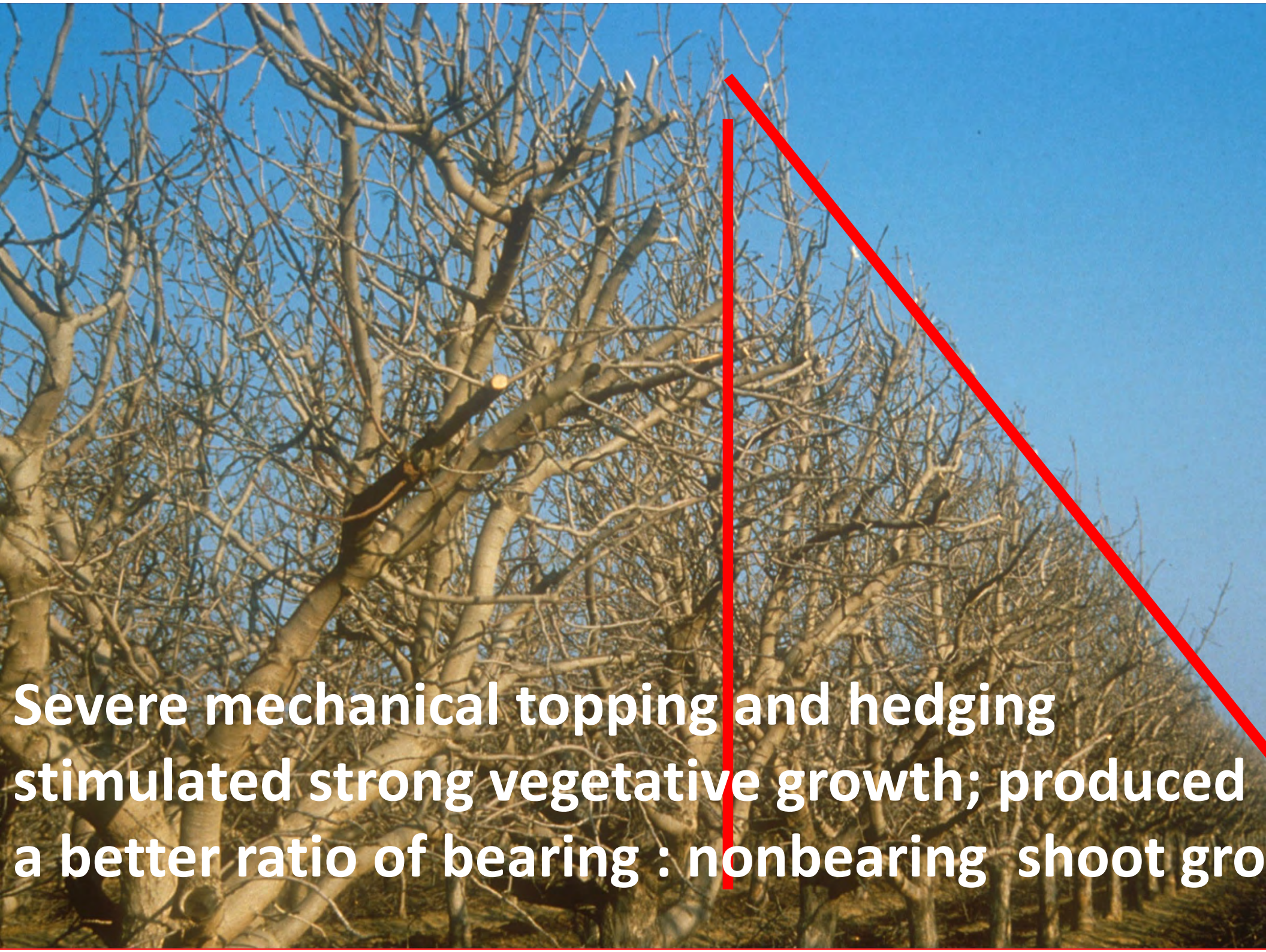
- Topping was more effective than hedging
- Was most effective prior the low crop year

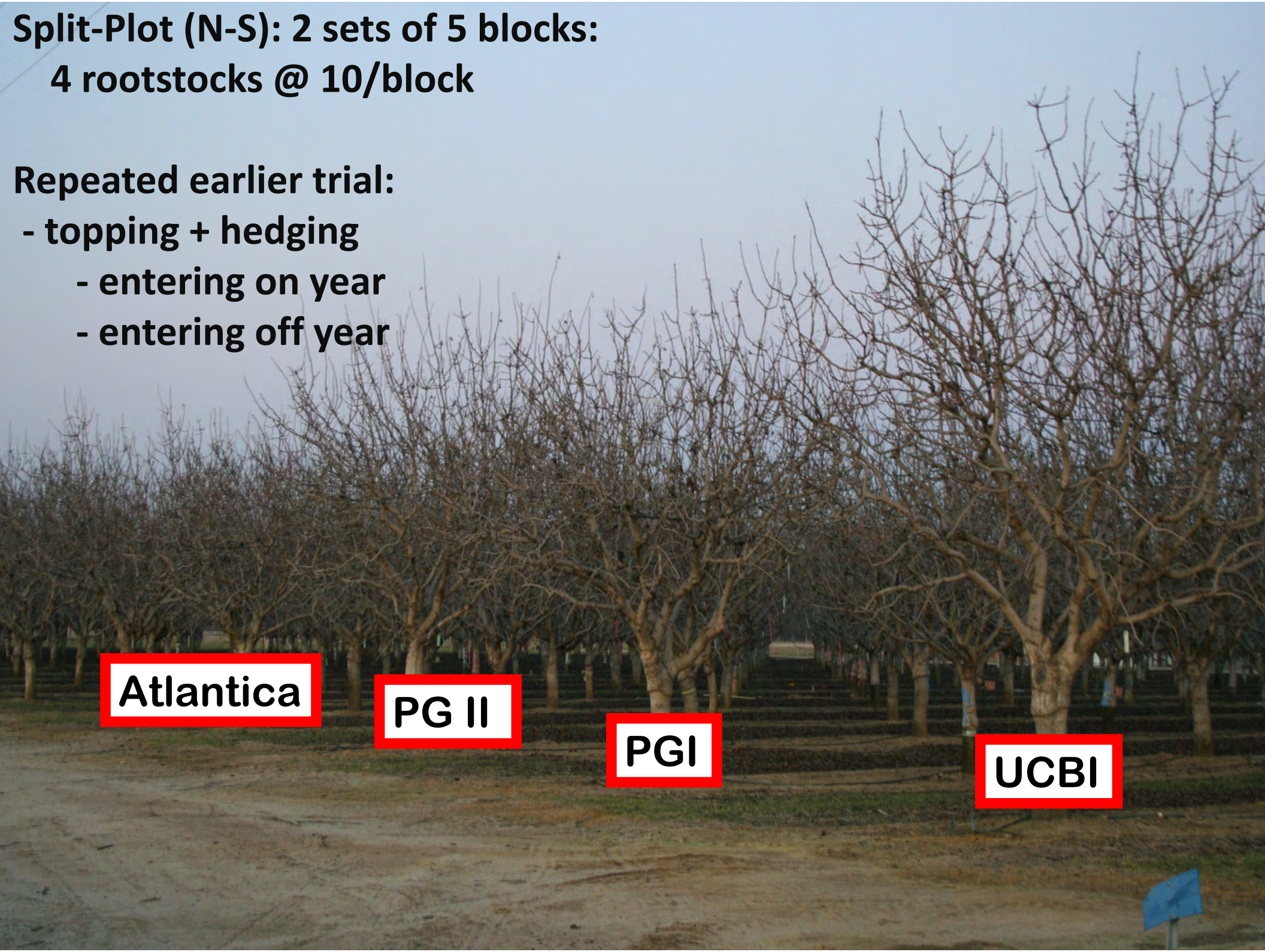
HortScience 30(7): 1369-1372. 1995.

Mechanical Topping Mitigates Alternate Bearing of 'Kerman' Pistachios *(Pistacia vera* L.)

L. Ferguson[1], J. Maranto, and R. Beede
Department of Pornology, University of California, Kearney Agricultural Center, 9240 South Riverbend Avenue, Parlier, CA 93648

Additional index words. Pistacia atlantica, hedging, pruning, nut quality, blanks, shell splitting


Severe mechanical topping and hedging
stimulated strong vegetative growth; produced
a better ratio of bearing : nonbearing shoot gro


Split-Plot (N-S): 2 sets of 5 blocks:
4 rootstocks @ 10/block
Repeated earlier trial:
- topping + hedging
- entering on year
- entering off year
Atlantica
PG II
PGI
UCBI

Rootstock	Topped & Hedged	Alternate Bearing Index	Average Lbs./Acre @ 128 trees/acre on or off year * Average of 6 year total
P. Atlantica	ON	.79	3552
P. Atlantica	OFF	.41	4049 (3800)* **4256 kg/ha**
P. Integerrima	ON	.55	4538
P. Integerrima	OFF	.21	4924 (4731)* **5298 kg/ha**
P. Integerrima X P. Atlantica	ON	.27	5442
P. Integerrima X P. Atlantica	OFF	.27	5425 (5433)* **6085 kg/ha**
P. Atlantica X P. Integerrima	ON	.29	5445
P. Atlantica X P. Integerrima	OFF	.30	5823 (5634)* **6320 kg/ha**

•Conclusions and Implications:

- 1995/2018 data consistent
- *P. atlantica**
  - 2018 data demonstrated an interaction between rootstock vigor and mechanical pruning that affected alternate bearing
    - *P. integerrima* = PGI*
    - *P. atlantica x P. integerrima* = UCBI*
    - *P. integerrima x P. atlantica* = PGII*

** Seedling Rootstocks*

Canopy Management: When

- Start when:
  - 6-8 years

Canopy Management: When

- Ends when:
  - bearing life

Canopy Management: When

- When during the season:
- April, May, June Dormant season:
  - Before hormone auxin starts suppressing bud break of lateral buds

Canopy Management: When

- Hormone:
- is a chemical produced in one place
- has a target elsewhere in the plant
- is a control chemical:
  - obtaining food and/or nutrients
- Auxins

Canopy Management: When

- Auxins:
- Produced in the stem, buds, and root tips
- Maintain apical dominance
- Enforce dormancy of lateral, subterminal, vegetative buds
- Removing apical bud stops auxin distribution that:
  - Inhibits lateral vegetative bud break

Canopy Management: When

- Want to prune before:
  - the apical bud breaks dormancy
  - suppresses vegetative bud break

Canopy Management: How

- Hand
- Mechanical + hand pruning

Two Pruning Methods

- Hand
  - Advantages
    - precise
  - Disadvantages
    - Expensive
    - Time Consuming
    - Difficult to teach
- Mechanical
  - Advantages
    - Less expensive
    - Decreases Alternate Bearing
  - Disadvantages
    - Indiscriminate

Canopy Management: How

- Function: expose leave to light
- Objective: harvestable tree and yield
- Assumptions:
  - Bigger tree: higher yield
  - Hand pruning: better horticulturally
- Decision: sustainability and economics

Canopy Management Requirements:

- Know difference between;
  - fruiting bud
  - Vegetative bud
- Know the bearing habit
  - Crop on 1-year old wood
  - Crop and shoots are apically dominant
- Know the cut and response
  - Heading
  - Thinning
- Recognize the tree shape you want

Canopy Management Requirements:

- Know difference between;
  - Fruiting bud
  - Vegetative bud

Canopy Management Requirements:

- Recognize bud transition on a branch

Canopy Management Requirements:

- **Understand bearing habit:**
- **Fruit on:**
  - **1 year wood**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Canopy Management Requirements:

- Understand bearing habit:
  - Apically dominant:

Canopy Management Requirements:

- **Know the cut and the response:**


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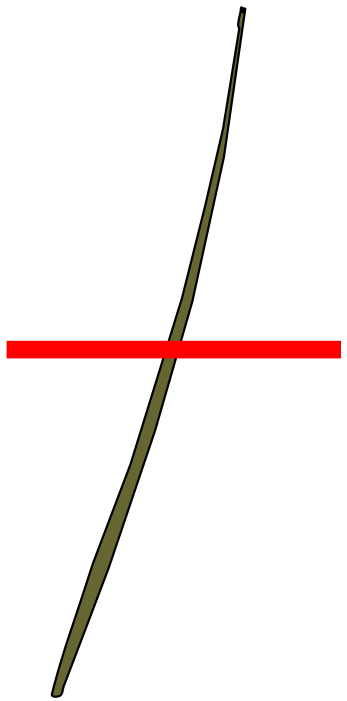
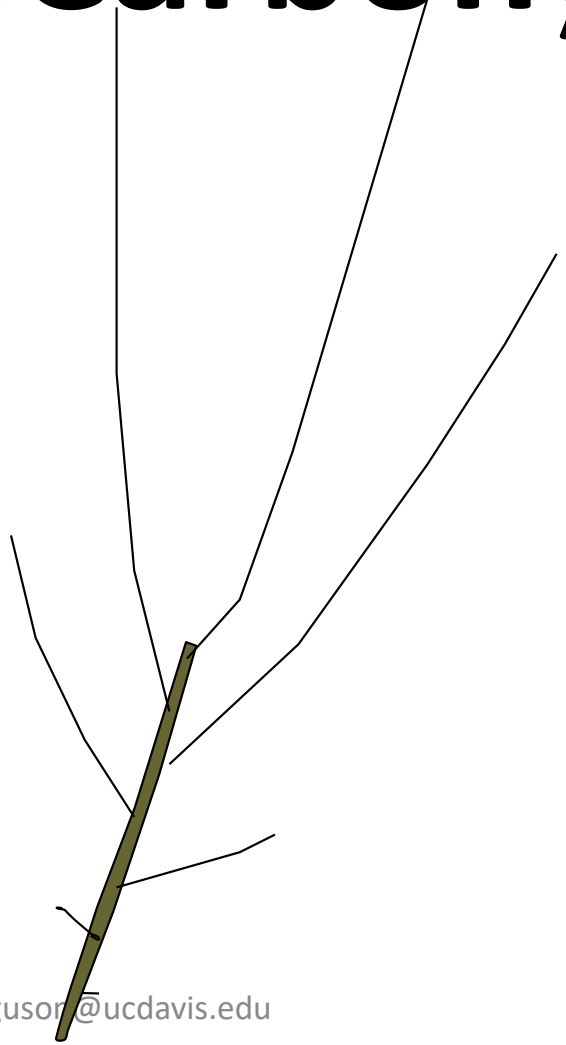
Types of Pruning Cuts

- **Heading cuts: shoot is cut midshoot**
  - **Destroys apical dominance**
  - **basal portion with less buds remain**
  - **removes stored carbohydrates**
    - **subtending and proximal shoot growth**
- **Thinning cuts: entire shoot is cut of at base**
  - **Thins the canopy**
  - **More light penetrtion**
  - **Decreases “damping” at harvest**

Heading Cut:
Destroys Apical Dominance

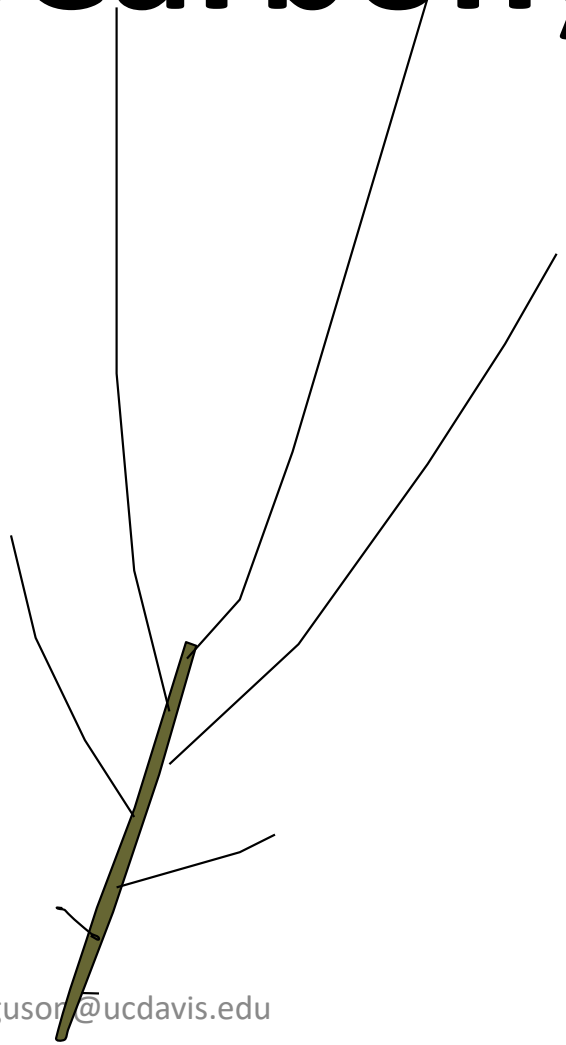


Heading Cut: Alters Bud:Carbohydrate Ratio



Encourages shoot growth

Heading Cut: Alters Bud:Carbohydrate Ratio



Encourages shoot growth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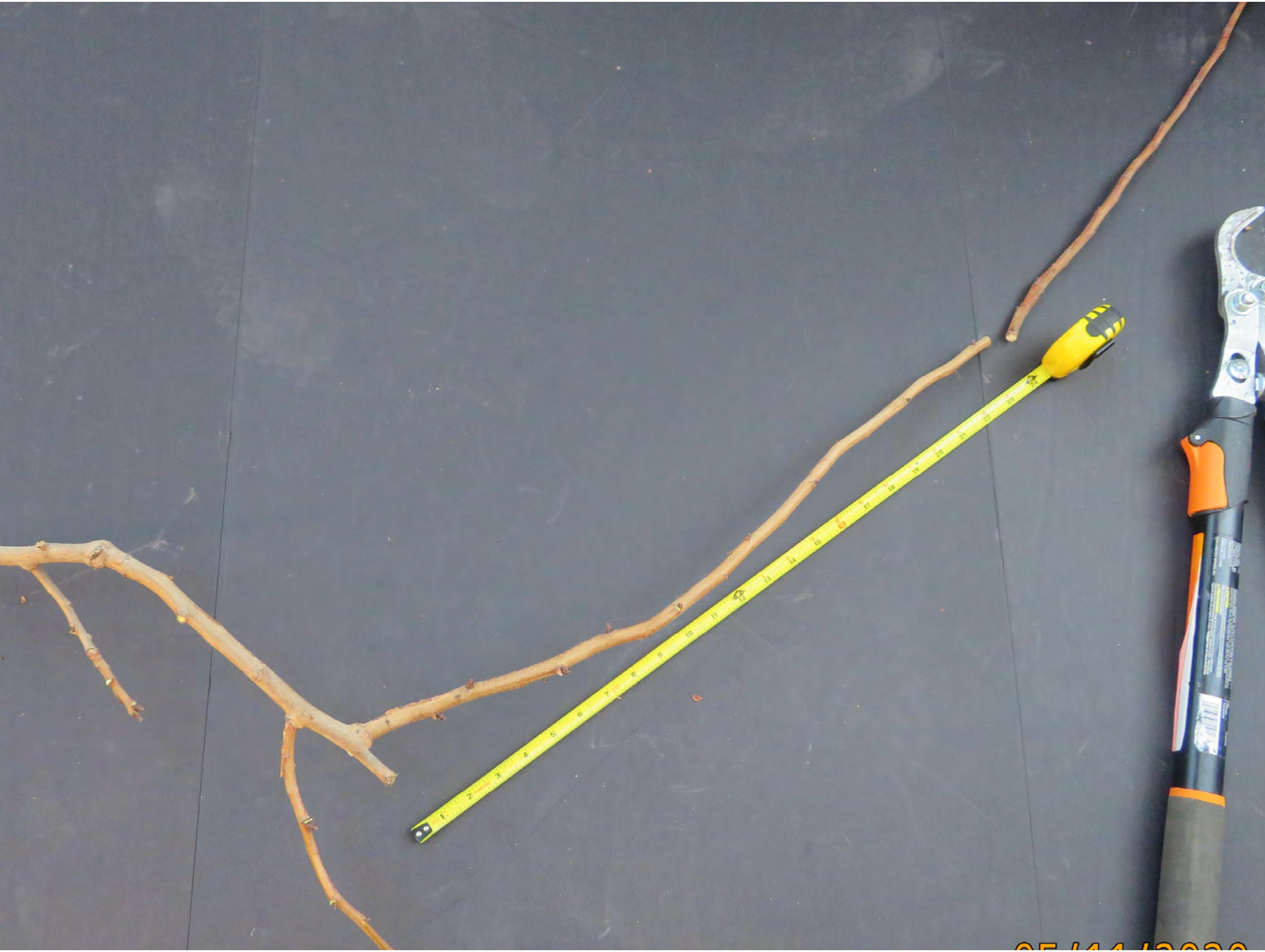
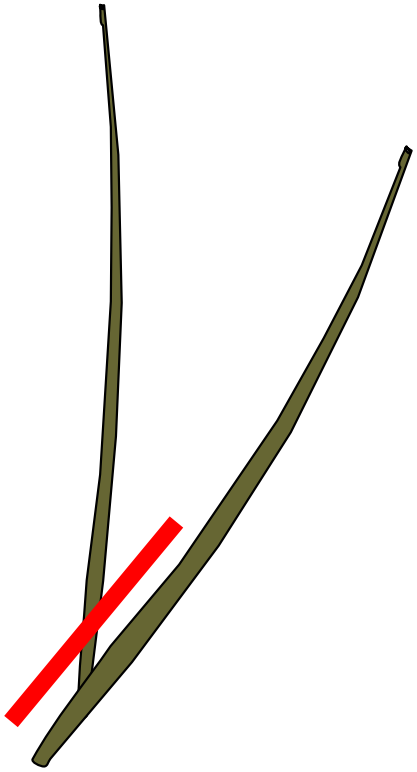


Thinning Cut: Removes Entire Shoot

Does not alter bud:carbohydrate ratio

- **less response**
- **tree canopy is thinned**
  - **letting light enter**

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Canopy Management Requirements:

- **Recognize tree shape you want.**

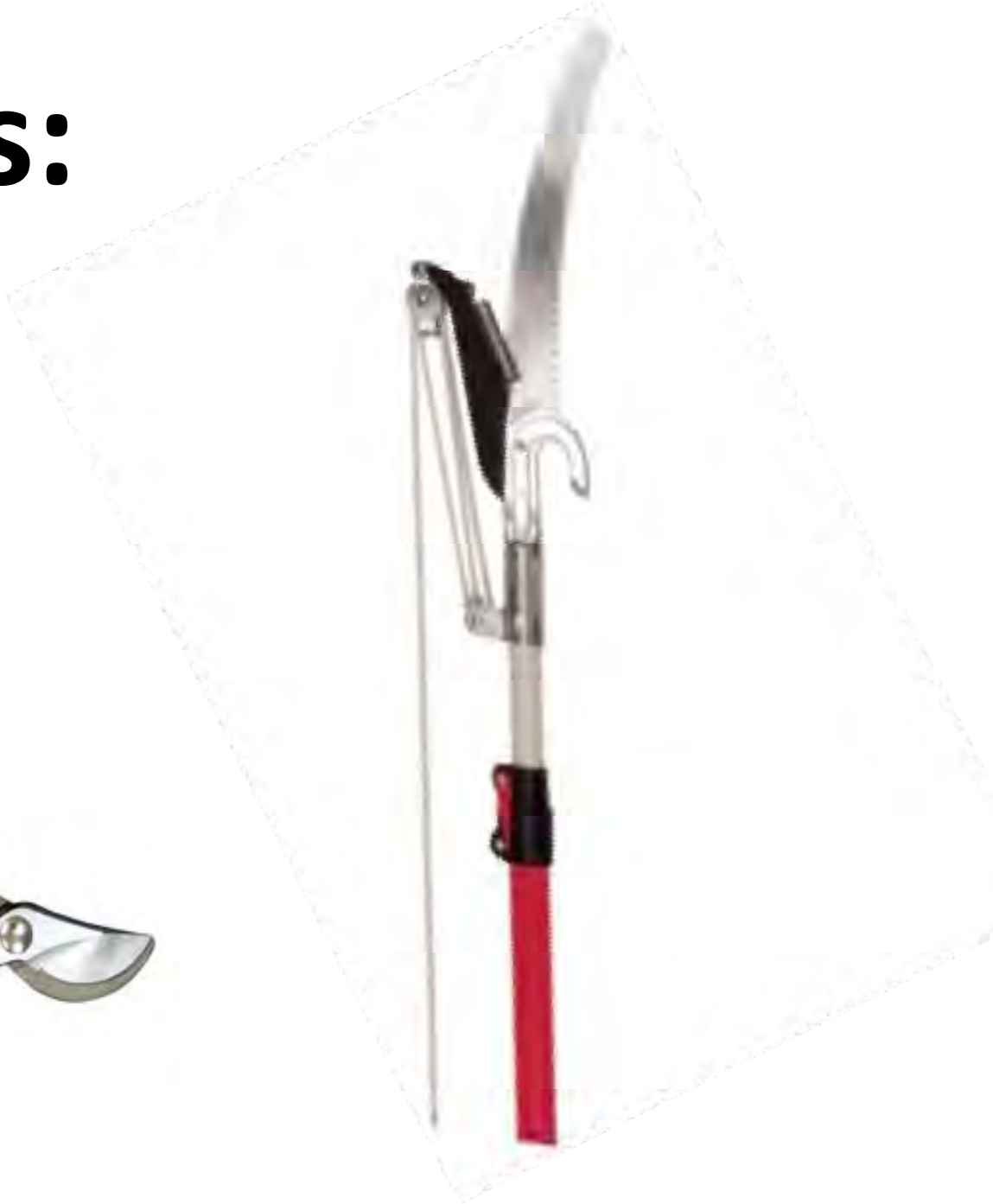
Desired Canopy Structure

- Compact and upright
- accessible trunk
- Scaffolds:
  - upright
  - short
  - stiff
- Canopy thinned
  - No damping

Canopy Management

- How to hand prune
    - Four steps
        - One: Low, flat, overlapping broken branches
            - won't shake, broken by harvester
            - thinning cut
            - loppers, saw
        - Two: Outside thinning cuts
            - push the canopy up
                - < 45* angle
            - loppers
        - Three: Inside heading cuts
            - snakes
            - loppers
        - Four: Tip the whips
            - tip the top canopy
            - pole pruners

Pruning Tools:



Canopy Management

- How to hand prune:
    - Four steps

        One: Low, flat, overlapping broken branches

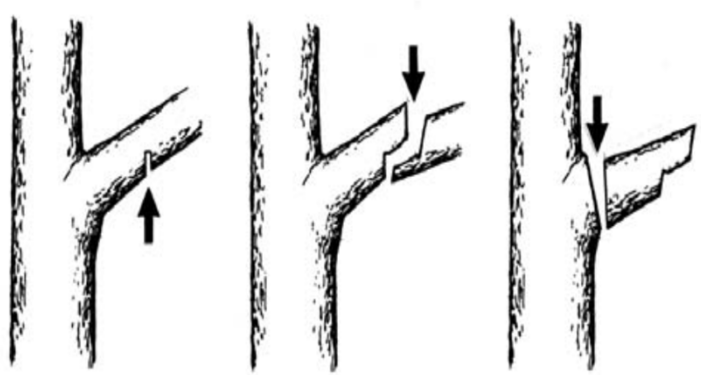
            - won’t shake, broken by harvester
            - thinning cut
            - loppers, saw

How to Prune…

- Do not cut branches flush with trunk
- Preserve branch collar = ridge in bark around base of branch
- Branch collar contains cells that make woundwood which grows over a pruning cut
- Branch collar also makes compounds to defend tree against decay
- Do not paint or tar wounds

How to Prune…

- Use a three-cut system for branches larger than 2.5 cm
- Prevents bark tearing or damage to remaining branch



- 1st cut: 1-2 inches from branch union
- Cut $^1/_3$ to ½ way through the branch from underneath (undercut)
- 2nd : A few cm up, cut from above, removing the branch.
- Make the final cut just above branch collar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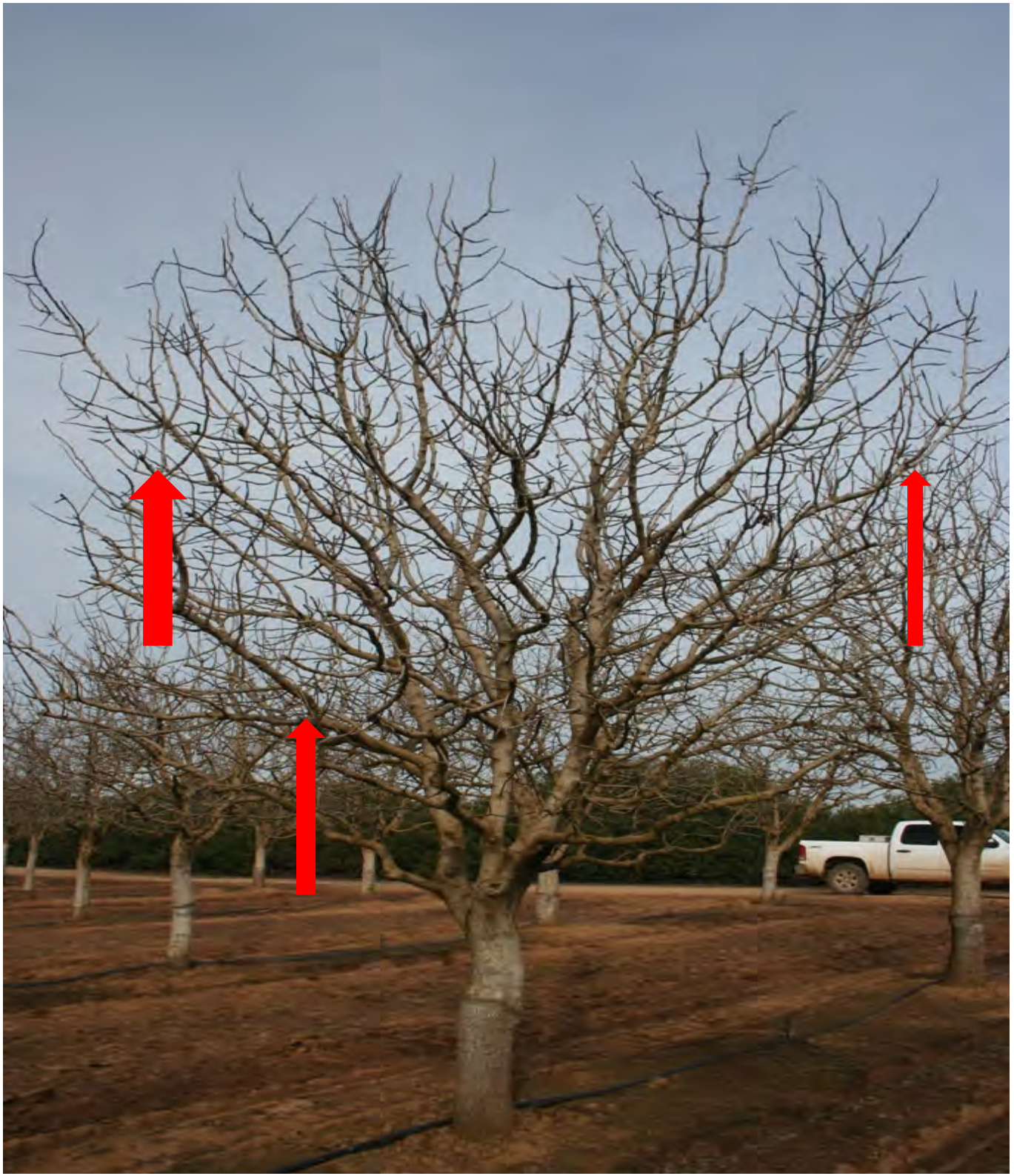
Canopy Management

- How to hand prune
    - Four steps
        - Two: Outside thinning cuts
            - push the canopy up
                - < 45* angle
            - loppers
            - pole pruners



Canopy Management

- How to hand prune
  - Four steps:
    Three: Inside heading cuts
    - snakes
    - loppers or saw


Watch out for Snakes!

Canopy Management

- How to hand prune
    - Four steps:
        Four: Tip the whips
            - tip the top canopy
            - pole pruners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Canopy Management

- How to hand prune
  - Four steps:
    - give each worker one step

Canopy Management

- Mechanical pruning:
  - Annual Topping
  - Every other year hedge
    - every other row middle
    - cross hedge
  - Orchard Floor Maintenance


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Canopy Management Costs

Hand:

- $300-500/acre

- Includes stacking shredding
- Trained crew

Mechanical:

- topping, hedging:
  - $28-35/acre/each
  - $70-87/ha/each
- If 5 mph:
  - good orchard floor
  - 40% less expensive
- With hand cuts:
  - $150/acre
  - $370/kilo

Tree Training and Pruning

Harvester

Canopy Management

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- Why
- When
- How (and who)
  - Hand
  - Mechanical
- Economics
  - Hand
  - Mechanical

Pistachio Production Manual

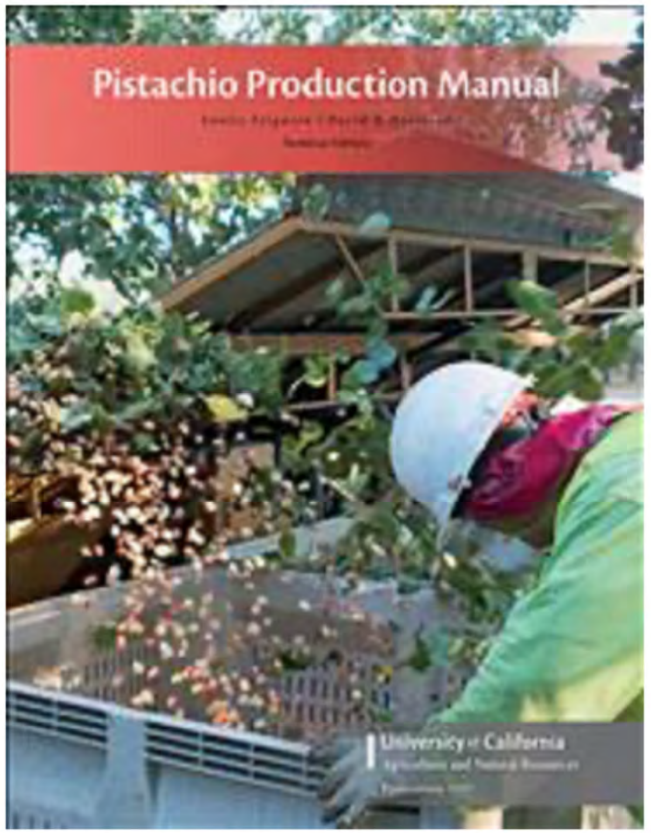
https://anrcatalog.ucanr.edu/Details.aspx?itemNo=3545

https://www.youtube.com/watch?v=ZRKDbcOWoZY

https://www.youtube.com/watch?v=k8xAWLEmkrU

https://www.youtube.com/watch?v=T3--YMHDIOE

https://www.youtube.com/watch?v=fS6wtsoPBbI&t=1s



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Questions ?

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