Developing Mechanical Harvesting for California Table Olives 2006 - 2012

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DSE, ENE Inc., AgRight, MacTeq
Rocky Hill Ranch, Burreson Ranches and Finca La Bella
Bell Carter Olives and Musco Family Olives
California Olive Committee


Rocky Hill Ranch
Exeter CA
Sept. 20th, 2012

$1,270/ton - $975/ton = 77% of gross return

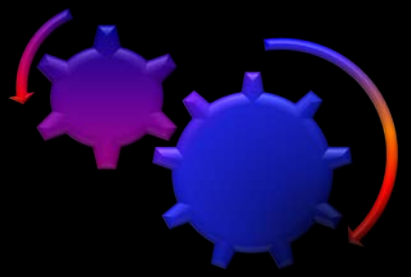
Available? Affordable? Ability?

March 9th, 2013
Terra Bella CA
- 1% ?


Tree
Harvester

Overall Strategy I

- Develop a removal method:
  - Acceptable processed product
    - Identify sources of fruit damage and mitigate
  - Doesn't harm tree
    - Identify source and mitigate damage
  - Develop a harvester:
    - Continuous motion
    - Catch and download fruit
      - » Commercial Cooperator

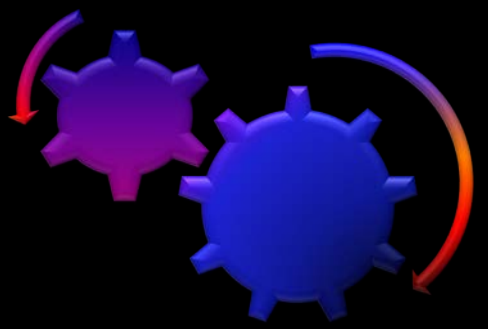


Overall Strategy II

- Develop new orchards
  - Increase harvester efficiency
- Adapt current orchards
  - Increase harvester efficiency

Overall Strategy III

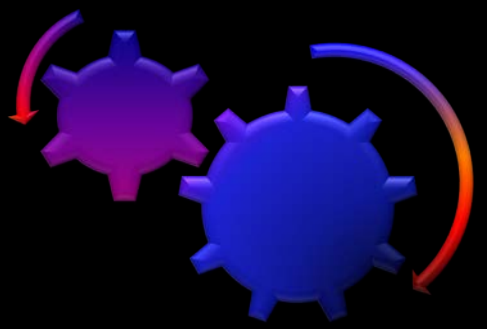
- Industry Adoption:
  - increasing net return




Tree
Harvester

Overall Strategy I

- Identified two removal methods:
  - Trunk shaking
    - Prunes, pistachios



Pruned trees:

$1,000.00/acre

180 trees/acre

30-40”/tree = 90 –129 trees/hour

3 tons/hour

22/09/2012: > 95% acceptable

Trunk Shaker vs. Hand Harvest

Trunk Shaker

- 30 tons (4 T/A on 7.5 A)
- 77.5% efficiency
- 10+ hours (spacing)
- $200.00 per ton
- $1,005.00 per ton
- 23,618 – 4,650
- **$18,968 net**

30 Pickers @ t/day

- 30 tons (4 T/A on 7.5 A)
- 100% efficiency
- 10 hours
- $400.00 per ton
- $1,005.00 per ton
- 31,150 – 12,000
- **$18,150 net**

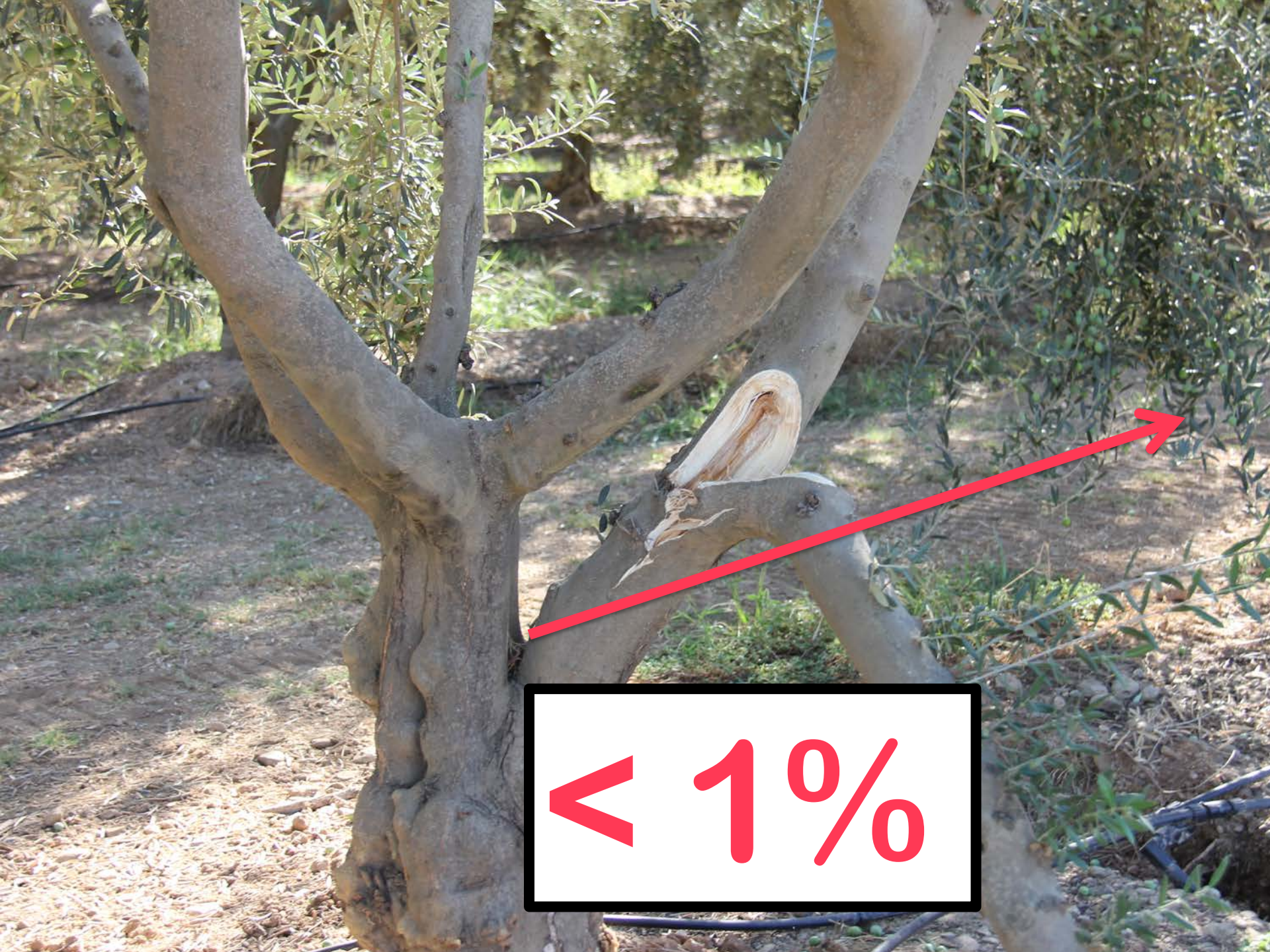
Trunk Shaker vs. Hand Harvest

Trunk Shaker

- 30 tons (4 T/A on 7.5 A)
- 77.5% efficiency
  - Increase with pruning
- 10 hours
- $200.00 per ton
  - $134.00/ton
- $1,005.00 per ton
- 23,618 – 4,650
- **$18,968 net**

30 Pickers @ t/day

- 30 tons (4 T/A on 7.5 A)
- 100% efficiency
  - 93 – 95%
- 10 hours
- $400.00 per ton
  - Not under your control
- $1,005.00 per ton
- 31,150 – 12,000
- **$18,150 net**

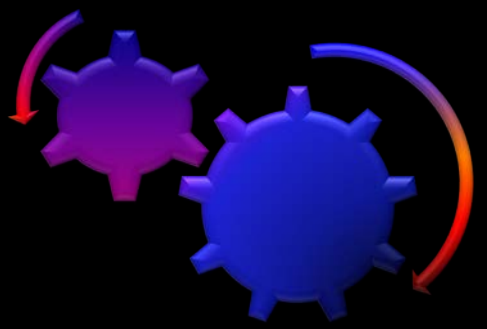

< 1%


< 7%


MORRISON'S
SINCE 1925
Net Contents One Gallon

Overall Strategy I

- Identified two removal methods:
  - Trunk shaking
    - Prunes, pistachios
  - Canopy contact
    - grapes



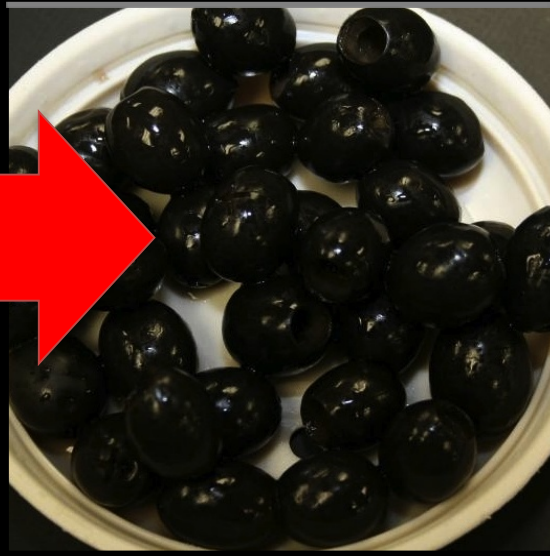
DSE 007, 008, 009, 010

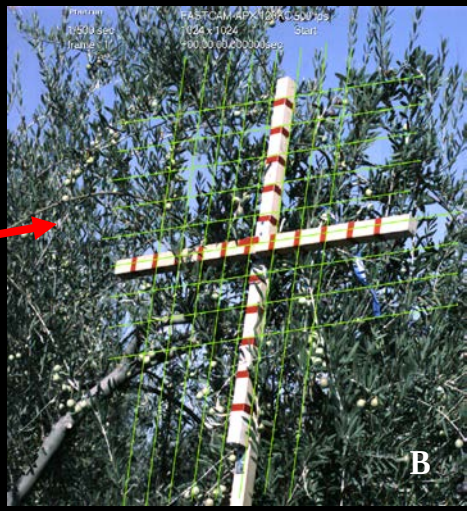

DMF

Hand

Mechanical

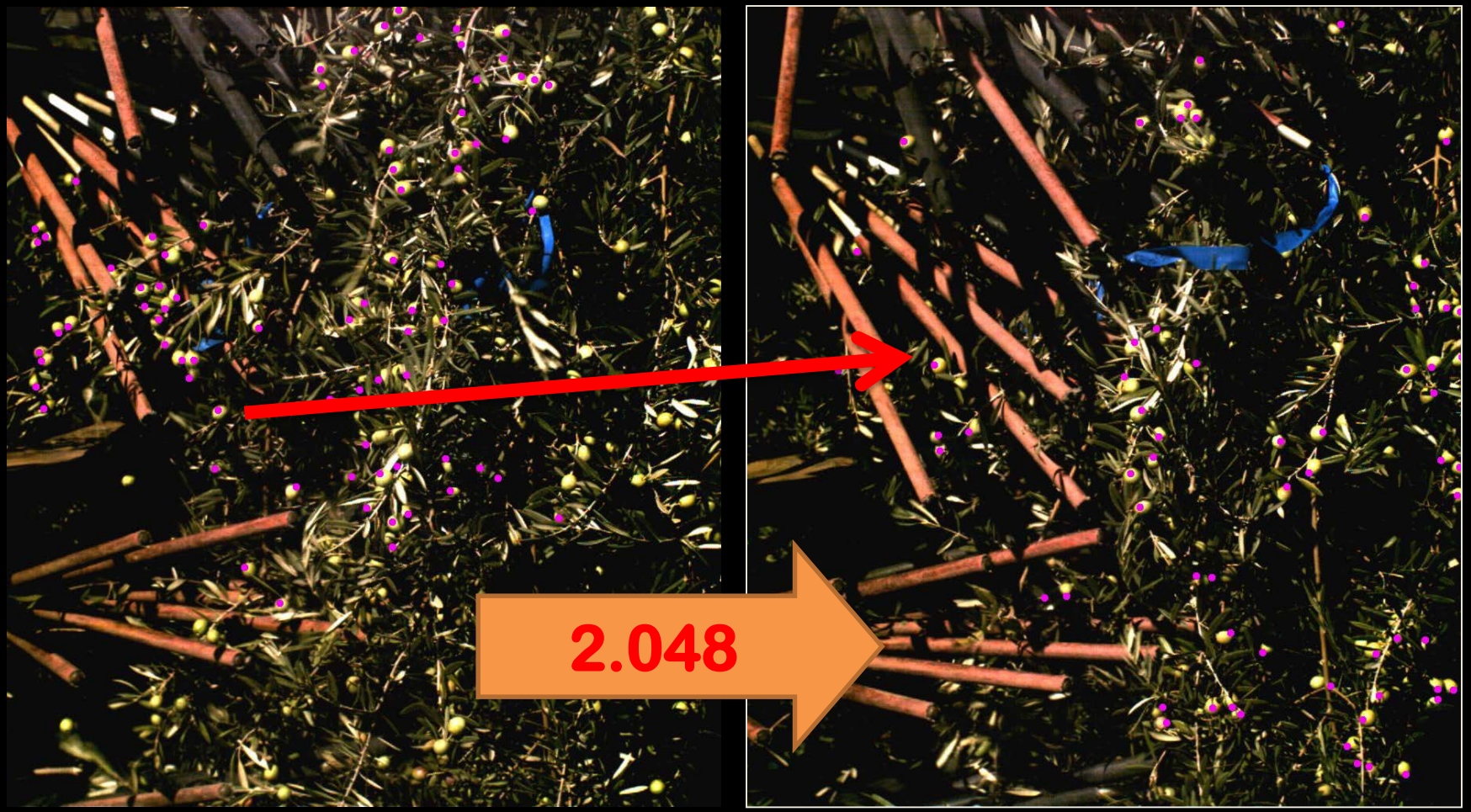
Processed



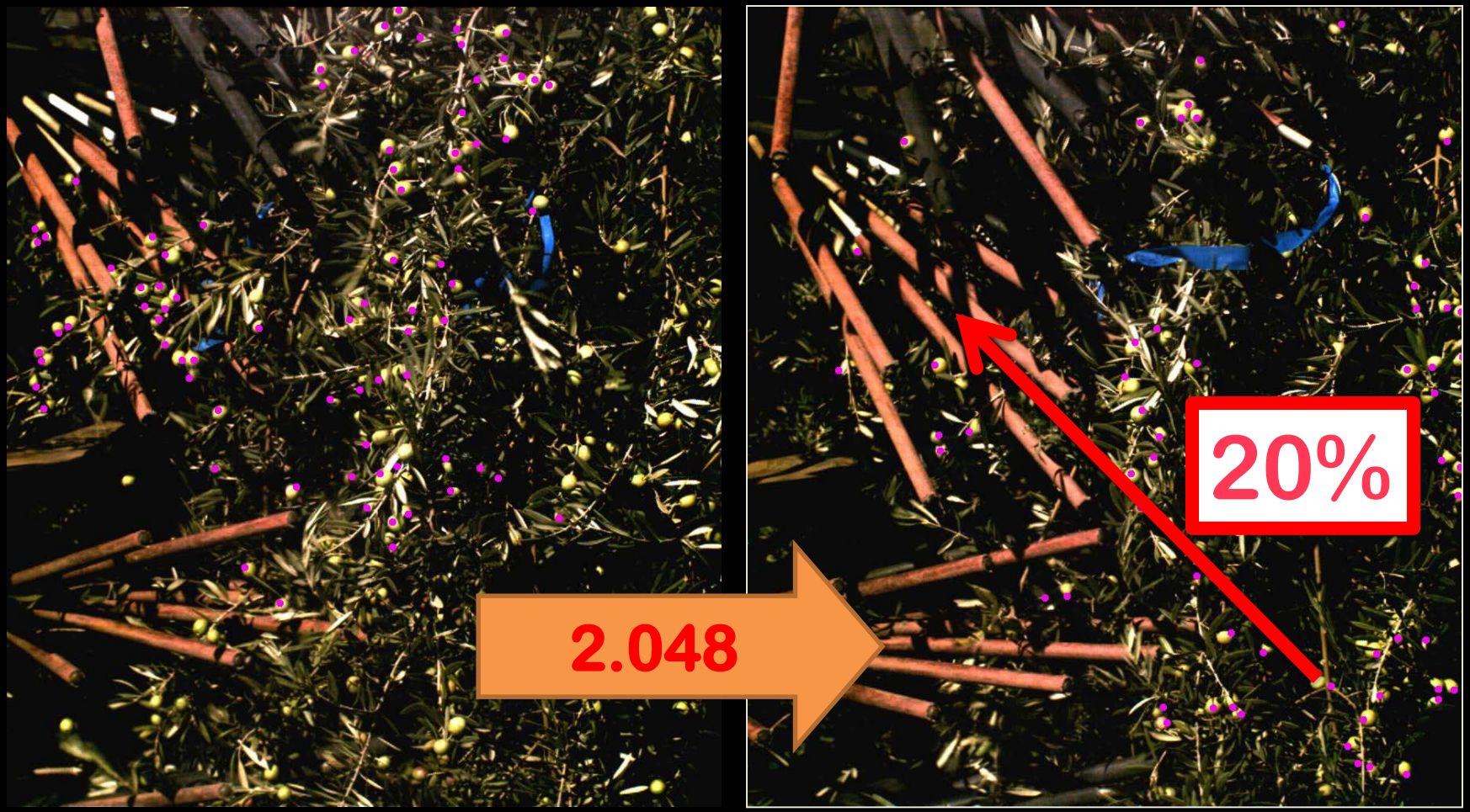


High Speed Filming: 500 FPS

High Speed Film Analysis



High Speed Film Analysis

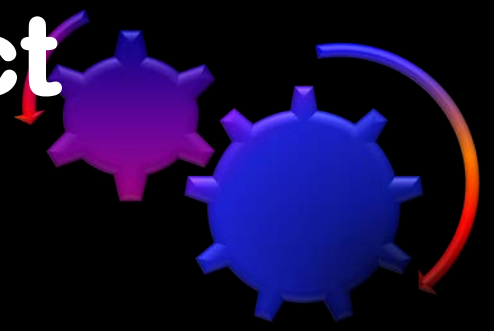


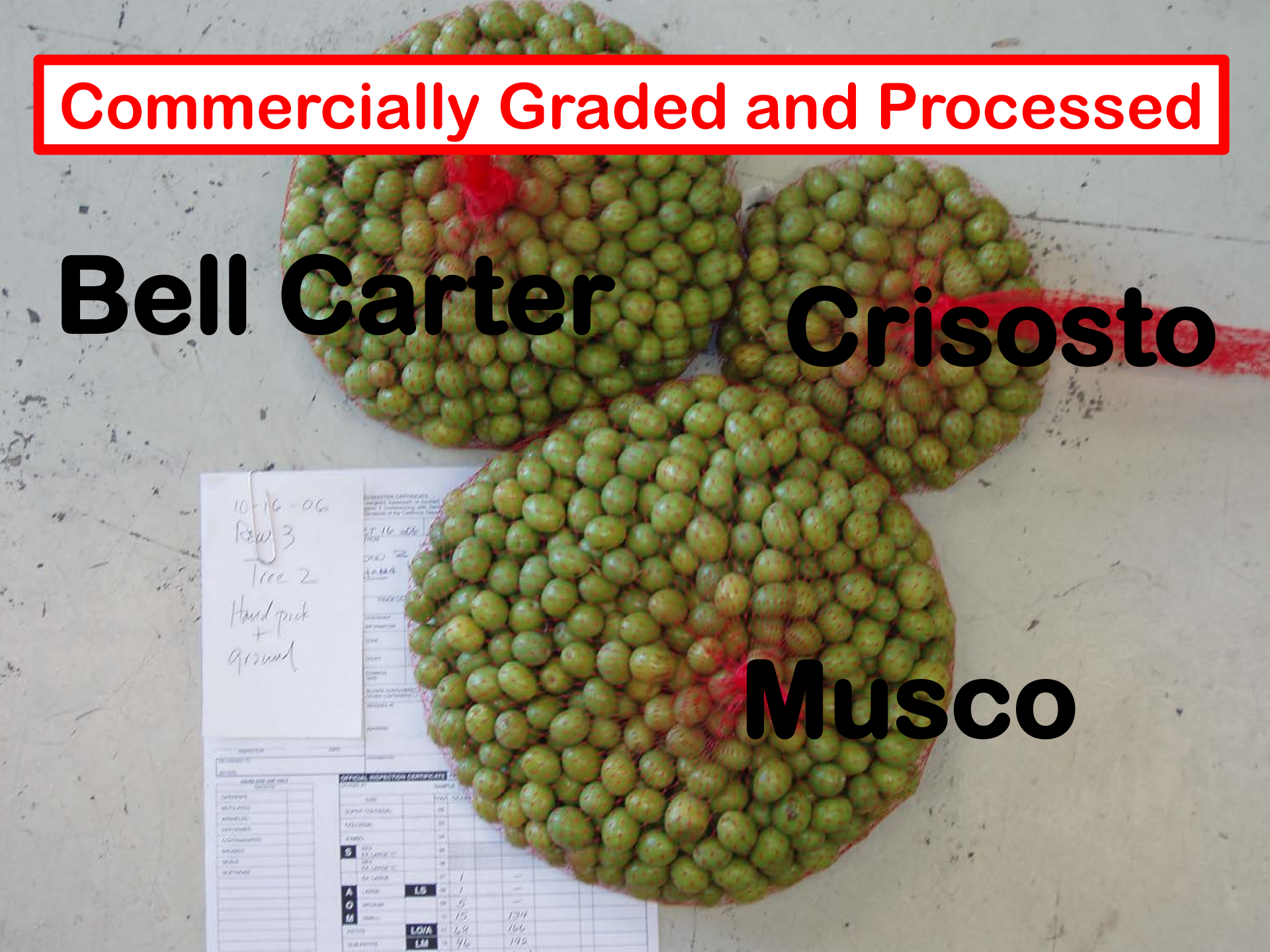
Overall Strategy I

- Canopy Contact Shakers:
  - Vibration parameters
    - Frequency of 4.5 – 5 Hz
    - 180 – 360 revolutions/minute
      - Canopy acceleration of 20-24 m/s
      - Amplified to 800 m/s along branch to fruit

Overall Strategy I

- Canopy Contact Shakers:
- Padding is essential
  - Rods and machine surfaces
  - 60 Shore A
  - loose to absorb impact




Commercially Graded and Processed
Bell Carter
Crisosto
Musco


Trained Sensory Panels

UCDAVIS OLIVE CENTER

Taste Test for Black Olives

1~ 3 pm

RMI Sensory Rm.1000

Consumer Preference Panels

10 ~ 3 pm

BHANDS

BMACHS

AHANDS

AMACHS

BCOMM

ACOMM

AHANDF

AMACHF

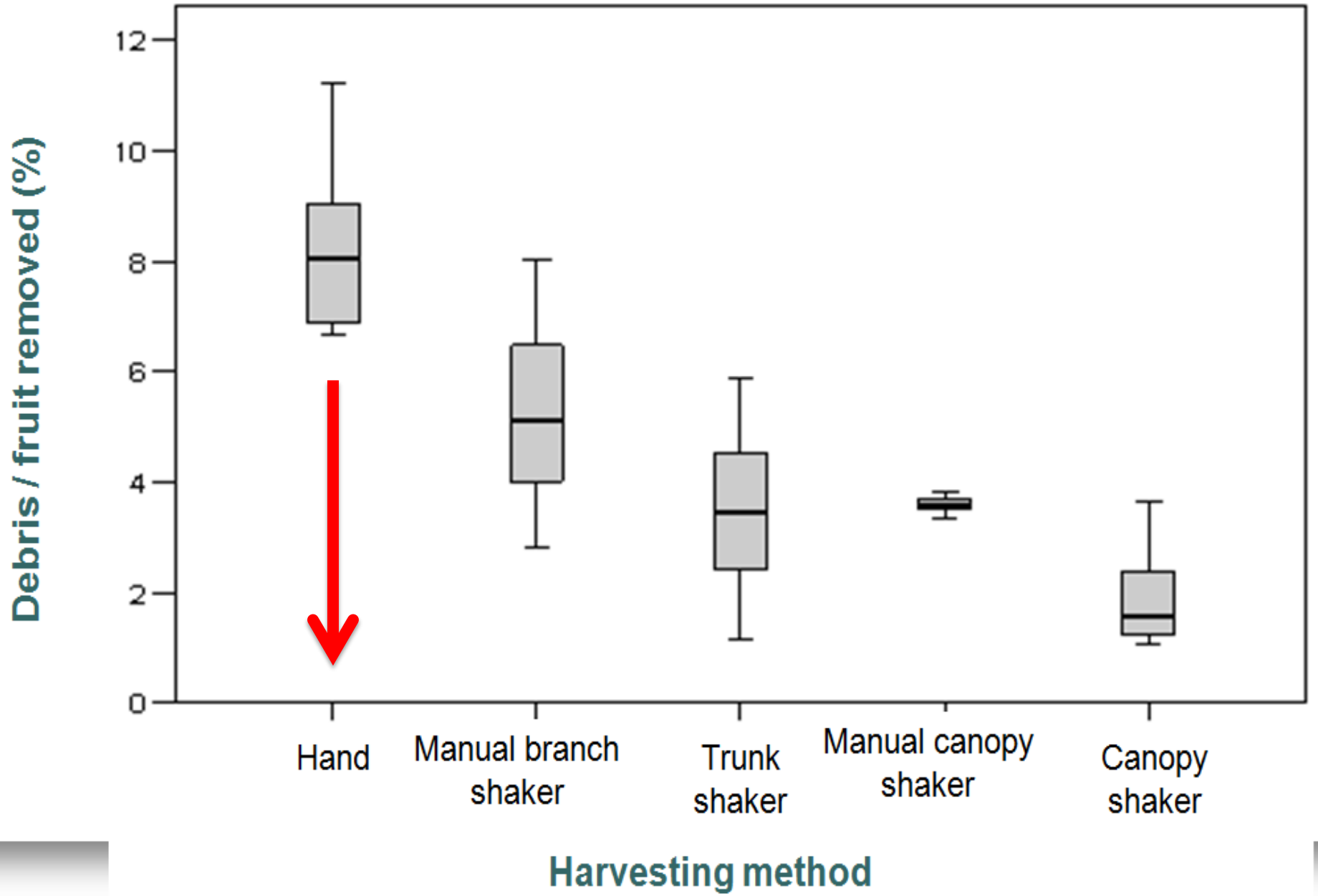
BHANDF

BMACHF

Could <u>not</u> distinguish Hand vs Mechanically Harvested Olives


Olive Knot from Canopy Damage

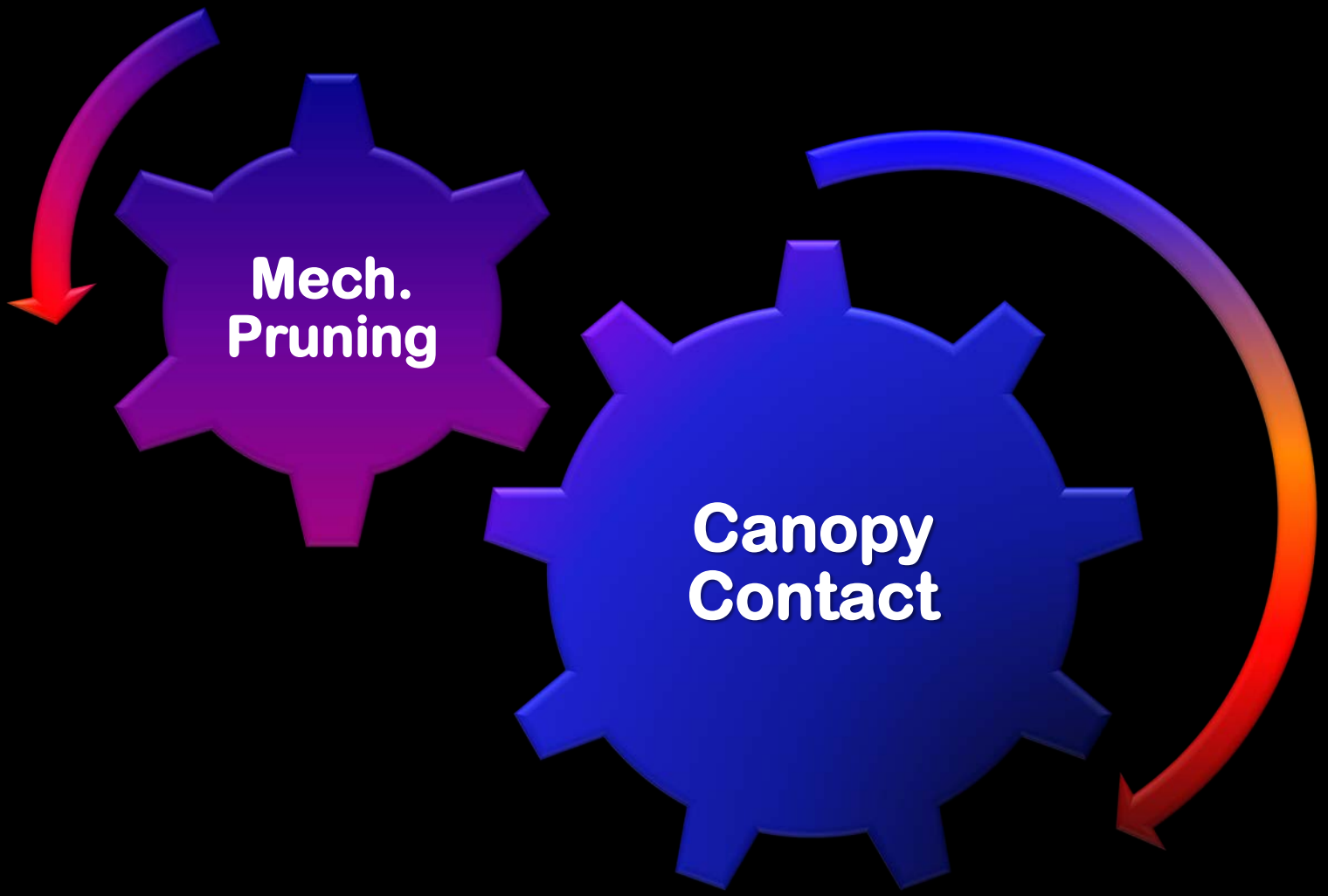
Debris (leafs and shoots) according to harvesting method

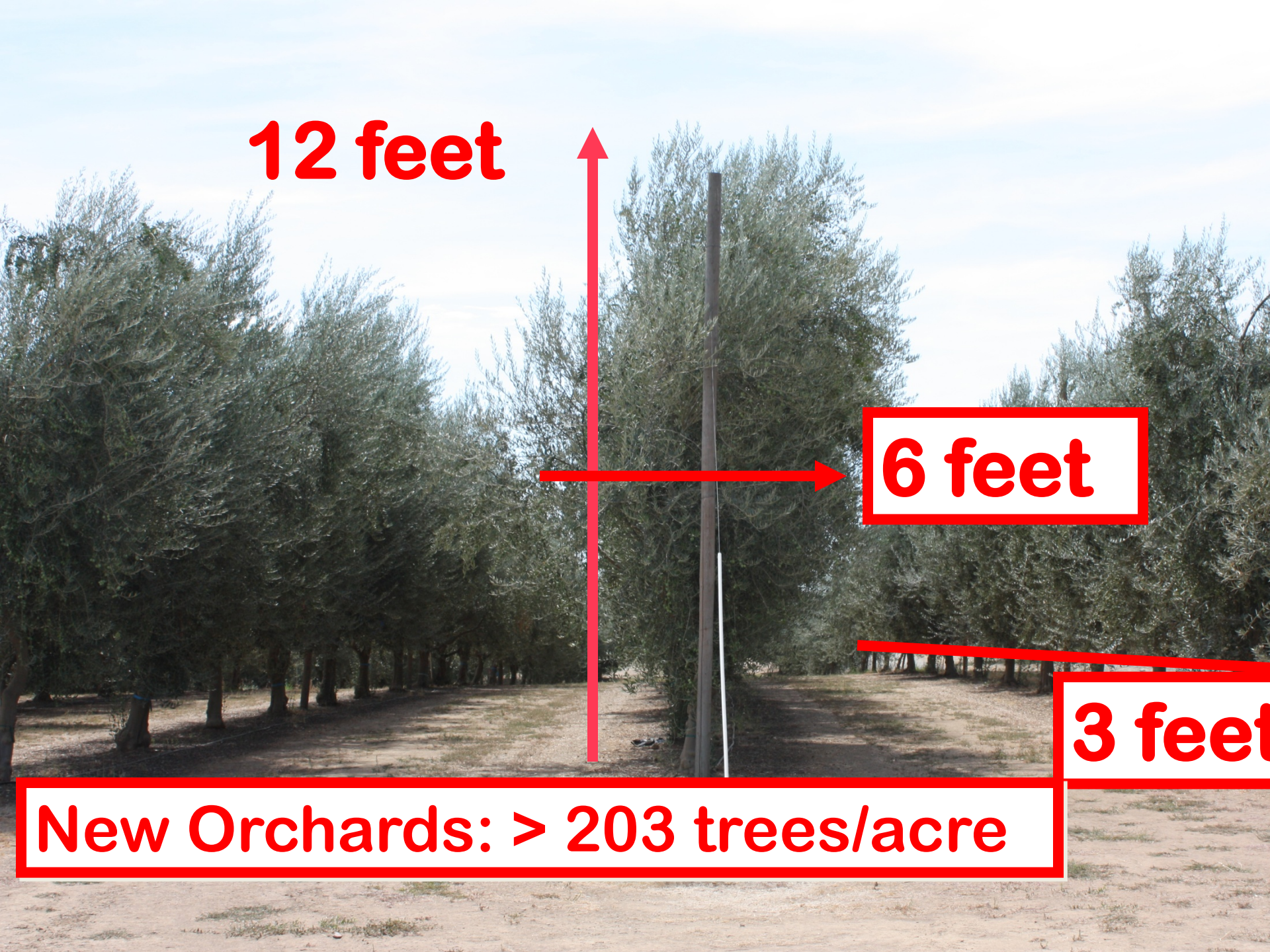



Colossus
MaqTec
Colossus

Agright Olivia

DSE 007, 008, 009, 010


Mech.
Pruning
Canopy
Contact


12 feet
6 feet
3 feet
New Orchards: > 203 trees/acre

Mechanically Harvested
Hand vs. Mechanically Pruned

Hand Pruned

- 2011 + 2012 yield:
  - 5.89 tons
  - 2.94 tons ave.
- Mech. Harvest Efficiency
  - 70%
  - Broke rods
  - Damaged bark

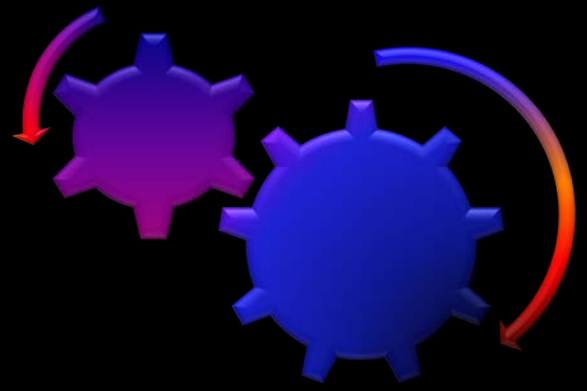
Mech. Pruned

- 2011 + 2012 yield:
  - 7.05 tons
  - 3.52 tons ave.
- Mech. Harvest Efficiency
  - 77%

Canopy Contact Head

Improvements Needed:

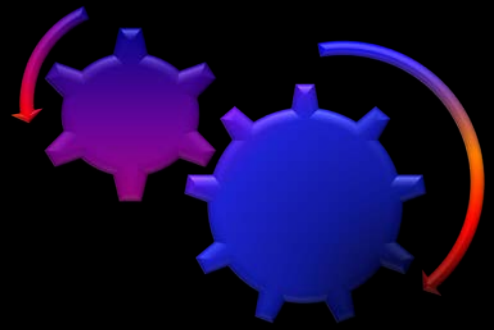
- better rod attachment
- needs catch frame



Canopy Contact Head

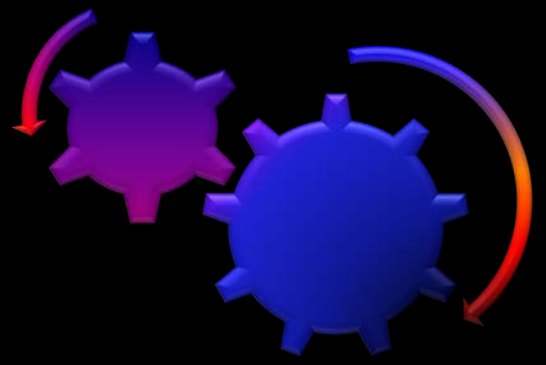
Economics:

- $25,000 to manufacture
- $3,000 monthly Bobcat rental
- 1.5 minutes per tree
  - 1.0 with two units
  - 2 hours/acre @ 139 trees/acre



Overall Strategy I: Results

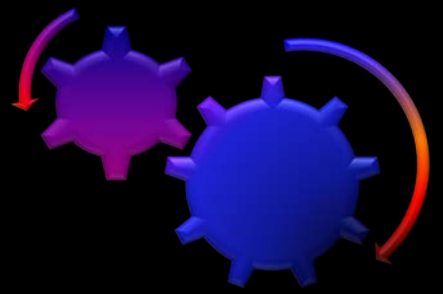
- Efficiency:
  - Trunk Shakers: 77%
    - commercial
  - Canopy Contact: 77%
    - prototype
    - no catch frame



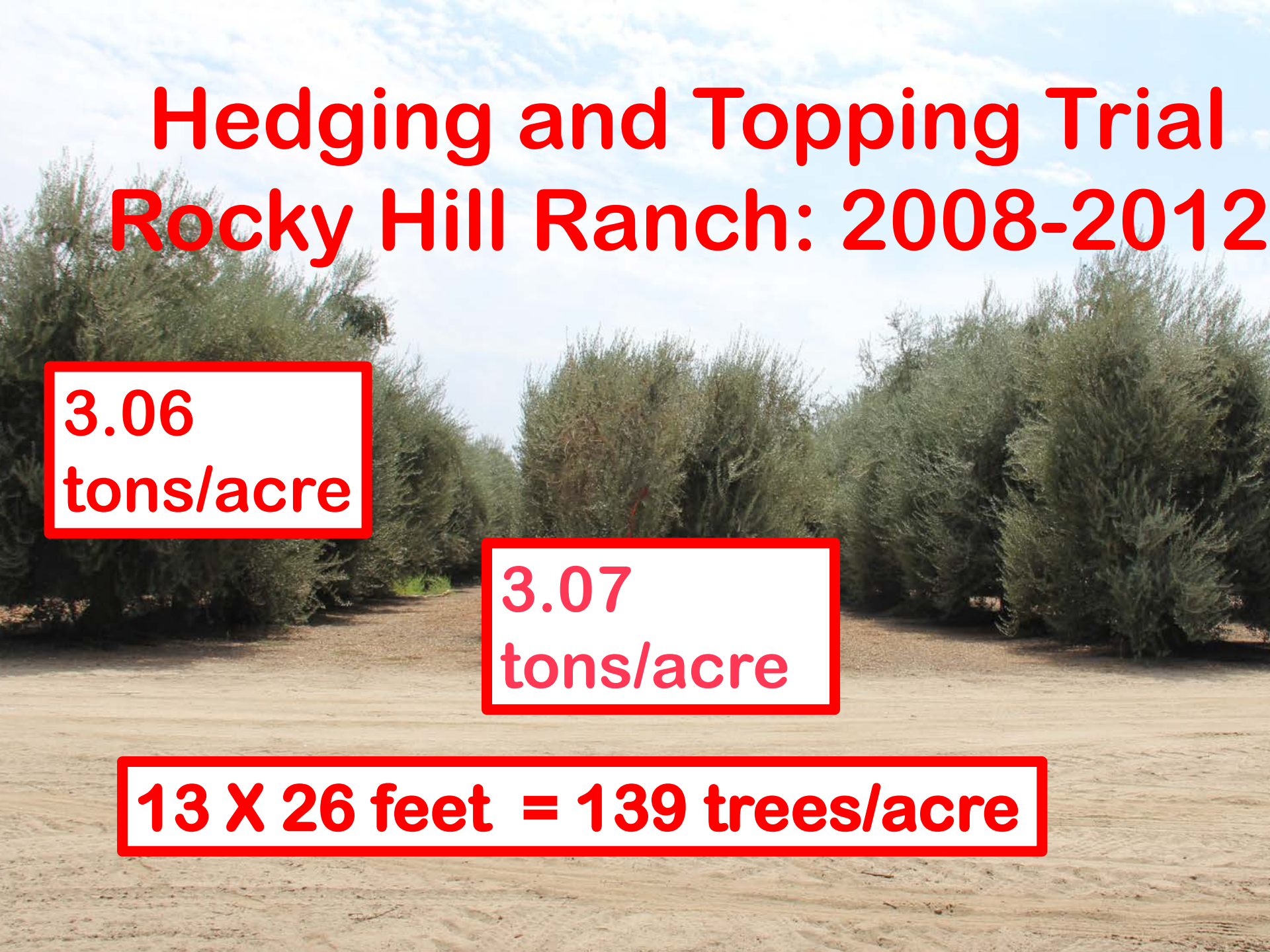

Tree

Overall Strategy II: results

- Develop new hedgerow orchards
  - Increase harvester efficiency
- Adapt current orchards
  - Increase harvester efficiency



Hedging and Topping Trial
Rocky Hill Ranch: 2008-2012



3.06
tons/acre

3.07
tons/acre

13 X 26 feet = 139 trees/acre

Hedging and Topping Trial 2008 - 2012

8% Higher Mechanical Harvesting Efficiency

Overall Conclusion I:

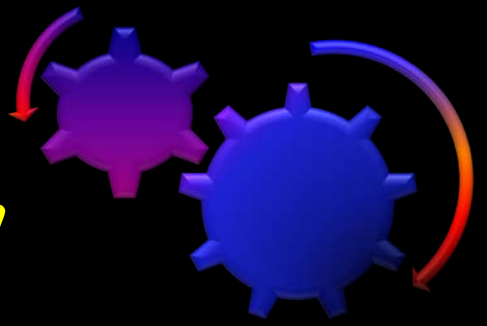
- Developed two removal methods
  - commercially acceptable fruit
  - achieved 77% efficiency
- Trunk shakers are commercial
- Canopy contact prototype
  - commerical cooperator
    - Blueprints available

Overall Conclusion II:

- Adapting or developing orchards
  - mechanical pruning increases harvester efficiency without decreasing yield

Overall Conclusion III:

- Olive industry adoption:
  - Commercial trunk shakers
    - available
  - Canopy contact shakers
    - getting final blueprints developed
      - available to anybody



California Olive Committee