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
$1,270/ton - $975/ton = 77% of gross return
March 9th, 2013
Terra Bella CA
- 1%?
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
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

<table>
<thead>
<tr>
<th>Trunk Shaker</th>
<th>30 Pickers @ t/day</th>
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</thead>
<tbody>
<tr>
<td>30 tons (4 T/A on 7.5 A)</td>
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<tr>
<td>77.5% efficiency</td>
<td>100% efficiency</td>
</tr>
<tr>
<td>10+ hours (spacing)</td>
<td>10 hours</td>
</tr>
<tr>
<td>$200.00 per ton</td>
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- $18,968 net
- $18,150 net
# Trunk Shaker vs. Hand Harvest

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<td>– $134.00/ton</td>
<td>– Not under your control</td>
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Overall Strategy 1

- Identified two removal methods:
  - Trunk shaking
    - Prunes, pistachios
  - Canopy contact
    - Grapes
High Speed Filming: 500 FPS
High Speed Film Analysis

2.048
High Speed Film Analysis

2.048

20%
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
Commerially Graded and Processed

Bell Carter

Crisosto

Musco
Trained Sensory Panels
Taste Test for Black Olives

1~3 pm
RMI Sensory Rm.1000

Consumer Preference Panels

10~3 pm
RMI Sensory Rm.1000
Could not distinguish Hand vs Mechanically Harvested Olives
Olive Knot from Canopy Damage
Debris (leafs and shoots) according to harvesting method

![Box plot showing debris/fruit removed (%) for different harvesting methods: Hand, Manual branch shaker, Trunk shaker, Manual canopy shaker, Canopy shaker. The Hand method has the highest variability, while the Canopy shaker method has the least.](image-url)
Agright Olivia
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

3.07 tons/acre

3.06 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
  – commercial 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