Mechanical Harvesting of California Oil Olives

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Economically Feasible Mechanical Harvesting

High Quality Olive Oil

- Training
- Pruning
- Final % Efficiency
- Tree Health
- Fruit Maturity
- FDF/fruit weight
Oil Olive Production Systems

Traditional
70 - 100/acre

High Density Hedgerow
150 – 300/acre

Super High Density Hedgerow
600 – 900/acre
Oil Olive Harvest Systems

Traditional Orchards

**Harvest Options:**

- Hand
- Picker aides
- Trunk shakers
- Brush head harvesters
18 feet
Oil Olive Harvest Systems

Traditional Orchards

Harvest Options:
• Hand
400/ton: 50% of gross return
Oil Olive Harvest Systems

Traditional Orchards

Harvest Options:

• Hand
• Picker aides
Comb Rake Heads
Oil Olive Harvest Systems

Traditional Orchards

Harvest Options:
• Hand
• Picker aides
• Trunk shakers
Wrap Around Trunk Shaker: 60%
Oil Olive Harvest Systems

Traditional Orchards

Harvest Options:
- Hand
- Picker aides
- Trunk shakers
- Brush head harvesters
Oil Olive Harvest Systems

Traditional Orchards

Harvest Options:
hand, aids, trunk shakers, brush heads
- Inefficient
- Damage unprepared tree
Traditional Orchards are not suitable for mechanical harvesting because the trees are not trained for mechanical harvesting!
Olive orchards should be developed with harvesting in mind!
Goal: Maximum net return per square meter of orchard floor!
Light = Photosynthesis
Photosynthesis = Carbohydrates
Carbohydrates = Bloom
Bloom = Olives = Oil
Key components of H-SHD Harvest

- Harvesters:
  - Operating parameters
  - Efficiency
  - Cost
  - Very little is UC data based
    - Why
    - How
Oil Olive Harvest Systems

High Density – Super High Density

- hand harvest
- harvest aids
- bow rod
- trunk shakers
- brush heads
Beater bars inside a moving catch frame
Bow Rod Harvesters
Bow Rod Harvesters

Adapted from Grape Harvesters:

- floatation tires
- double floatation tires
- tread tracks
- self propelled or pull behind
Bow Rod Harvesters

Adapted from Grapes

- 8 - 10 feet internal height
- 4 - 12 feet internal width
- 2.5 – 3 bottom trunk clearance
Bow Rod Harvesters

Efficiencies and speed:

- over 90% efficient
- 1.0 – 1.5 mph = 15 acres/day
  - Slower for heavier crops
Bow Rod Harvesters

Costs: Contract Harvesting

- $325.00 to 350.00 per acre
- $250.00 per acre for young trees
  - < 5 tons/acre
Bow Rod Harvesters

Acre threshold for ownership:

- $150,000 – $350,000 per machine
- 350 – 400 acres
Bow Rod Harvesters

Problems:

- Rod life of 350 – 400 hours
- Branch damage -> olive knot
- Poor skirting decreases trunk closure
Bow Rod Harvesters

Manufacturers:
- AGH Olivetum: track option
- Korvan
- Gregoire
- Vinestar: pull behind
- Braud New/Holland
- Pellenc
Gregoire Grape Harvester
Vinestar
Pull Behind
PTO
Straddle
Harvester
10 ft Tall
Trunk Shaking Harvesters

Manufacturers:
- ENE Inc
- Coe
- OMC
Trunk Shaking
Harvesters

Operating Parameters and costs:
- 4 trees/minute
- catch frame bed 6 – 12 feet
- $200 – $210.00 per acre
Trunk Shaking Harvesters

Problems

- **Barking:**
  - Clamp @ 800 PSI
  - Longer pads for better trunk contact
  - Modified padding material

- Harvests better closer to origin of shake
Trunk Shaking Harvesters

Manufacturers:

- ENE Inc
- Coe
- OMC
$y = -10,55x + 454,4$

$R^2 = 0,511$
Coe Pistachio harvester
Brush Head Harvesters
Brush Head Harvesters

Operating Parameters:

- MacTeq Colossus: Manzanillos in Argentina
  - 10-15 sec/tree
  - 97% removal
- Agright Olivia
  - 69% poorly prepared table olives
Brush Head Harvesters

Manufacturers:

- Agright Olivia
- Oxbo Citrus Harvester
- Coe Pomegranate Harvester
- MacTeq Colossus
- Haslett Coffee Harvester
Coe Pomegranate Harvester
<table>
<thead>
<tr>
<th></th>
<th>Colossus</th>
<th>Shaker</th>
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<tbody>
<tr>
<td>Trees/hr</td>
<td>79</td>
<td>74</td>
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<td>Cost/kg fruit</td>
<td>$0.28</td>
<td>$0.23</td>
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2nd Australia Comparison

Side-by-side shaker – Braud grape – Gregoire grape – Haslett coffee - Colossus

- 90-180 trees/hr. (large and small trees)
- 71 to 92% efficiency
- 0.2 to 1.0% canopy damage
- 0.25 to 0.45% trunk damage
- $416/hr
2nd Australia Comparison

Side-by-side shaker – Braud grape – Gregoire grape – Haslett coffee - Colossus

- 400-550 trees/hr. (small trees only)
- 87 to 97% efficiency
- 3.0 to 4.9% canopy damage
- 0.20 to 0.35% trunk damage
- $335/hr

Leandro Ravetti
2nd Australia Comparison

Side-by-side shaker – Braud grape – Gregoire grape – Haslett coffee - Colossus

- 200-350 trees/hr. (small trees only)
- 78 to 94% efficiency
- 3.1 to 6.5% canopy damage
- 0.25 to 0.35% trunk damage
- $444.5/hr

Leandro Ravetti
2nd Australia Comparison
Side-by-side shaker – Braud grape – Gregoire grape – Haslett coffee - Colossus

- 150-280 trees/hr. (small trees only)
- 86 to 94% efficiency
- 3.2 to 5.0% canopy damage
- 0.10 to 0.30% trunk damage
- $272.75/hr

Leandro Ravetti
2nd Australia Comparison

Side-by-side shaker – Braud grape – Gregoire grape – Haslett coffee - Colossus

- 90-250 trees/hr. (large and small trees)
- 86 to 97% efficiency
- 0.5 to 3.5% canopy damage
- 0.10 to 0.15% trunk damage
- $352.31/hr

Leandro Ravetti
Australian Harvester Comparison
Trees per hour

• Side-by-side shaker – 90-180
• Braud grape – 400-550 (small trees only)
• Coffee – 150-280 (small trees only)
• Gregoire grape – 200-350 (small trees only)
• Colossus – 90-250
Australian Harvester Comparison

Harvest Efficiency %

- **Side-by-side shaker** – 71-92%
- **Braud grape** – 87-97% *(small trees only)*
- **Coffee** – 86-94% *(small trees only)*
- **Gregoire grape** – 78-94% *(small trees only)*
- **Colossus** – 86-97%
Australian Harvester Comparison
Canopy Damage %

- Side-by-side shaker – 0.2-1.0%
- Braud grape – 3.0-4.9% (small trees only)
- Coffee – 3.2-5.0% (small trees only)
- Gregoire grape – 3.1-5.5% (small trees only)
- Colossus – 0.5-3.5%
Australian Harvester Comparison
Hourly Rate ($AUS)

- Side-by-side shaker – $416
- Braud grape – $335 (small trees only)
- Coffee – $273 (small trees only)
- Gregoire grape – $445 (small trees only)
- Colossus – $352
Oil Olive Harvest Systems

High Density and Super High Density

- Hand: expensive, slow
- Harvest aides: expensive, slow
- Shakers: HD and SHD
- Over the row harvesters: SHD
- Brush Heads: HD and SHD
Conclusions

Economically feasible oil olive harvesting

- Spacing
- Training and pruning
- Continuous harvesting
- Integrated pickup and transport
- Monitored and analyzed for cost
- Not harm olive oil quality
- Not harm tree health

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Other Considerations

• Abscission Compounds
  – no consistent results

• Postharvest transport and storage
  – 5 – 10 mm/CO2/Kg/H @ 41°F (5°C)

• Postharvest tree treatment
  – Immediate/as needed copper for olive knot
Questions?