The objective of mechanical harvesting is to decrease harvesting costs and increase “on-tree” revenues. Mechanical systems should increase overall harvest labor productivity, thereby reducing the number of workers needed to harvest citrus. Since 1995, the Florida Dept. of Citrus (FDOC) has lead the effort to research and develop citrus mechanical harvesting systems. The University of Florida has been collecting data to evaluate the performance of commercial systems, impact of grove conditions on harvesting performance, and assessing economic potential of mechanical harvesting.

### 2004-2005 Commercially Available Machines

**Trunk-Shake-Catch (TSC)**

A TSC set includes three machines—a shaker, a receiver, and a field truck (goat). Trunks are shaken between 5 and 10 seconds to remove fruit. Trees have to be “skirted” to allow shaker and receiving units to position underneath the tree canopy. Fruit is caught and conveyed to a cart holding up to 90 boxes of fruit.

**Continuous Canopy Shake & Catch (CCSC)**

One CCSC set includes a minimum of four machines—two harvesting units and two field trucks. Working in parallel, a CCSC system travels between 1 and 2 mph down each side of the tree row. Shaker heads penetrate the canopy to remove fruit. Caught fruit is conveyed to a trailing field truck. CCSC system is well suited for long rows and uniform sized trees. Trees have to be “skirted” to allow optimal fruit collection.

**Tractor Drawn Canopy Shake (T-CS)**

T-CS uses a harvesting mechanism similar to the CCSC. T-CS harvests fruit from one side of the tree canopy at a time, dropping fruit to the ground. A hand crew picks up ground fruit and glean remaining fruit in the tree. Skirting is recommended but not necessary.

### Machine Performance Statistics

<table>
<thead>
<tr>
<th></th>
<th>TSC</th>
<th>CCSC</th>
<th>T-CS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hamlin Valencia</strong></td>
<td>190 229 246 466</td>
<td>96 76 103 122</td>
<td>16 20 184 298</td>
</tr>
<tr>
<td><strong>Harvest Speed (Tree/hr)</strong></td>
<td>87% 88% 90% 90%</td>
<td>55% 37% 46% 37%</td>
<td>37% 31% 37% 31%</td>
</tr>
<tr>
<td><strong>Labor Productivity (Bx/man-hr)</strong></td>
<td>96 76 103 122</td>
<td>190 229 246 466</td>
<td>377 312 377 312</td>
</tr>
</tbody>
</table>

The data above represents systems used in a variety of grove conditions without abscission chemicals.

### Mechanical Harvesting Costs and Benefits Worksheet

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Skirt</td>
<td>$10 - $20</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td>Pruning</td>
<td>$30 - $40</td>
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<td></td>
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</tr>
<tr>
<td>3</td>
<td>Micro jet placement</td>
<td>$30 - $40</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Hand</td>
<td>$1.60</td>
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<td></td>
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<td>5</td>
<td>Total</td>
<td>$10 - $140</td>
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</tbody>
</table>

### Future Challenges For Mechanical Harvesting Systems

1. Incorporating abscission agents to extend the harvesting season
2. Developing new grove design and tree shapes to enhance machine performance
3. Addressing logistics of trailer allocations
4. Addressing grower concerns as to tree health, crop yield, and grove aesthetics