The Economics of Citrus Greening
THE END OF ORANGE JUICE

A devastating disease is killing citrus trees from Florida to California

By Anna Kuchment
DISEASE IMPACTS
Citrus Greening

- Huanglongbing (HLB), also known as citrus greening, is a fatal bacterial disease:
  - Spread tree to tree by the Asian Citrus Psyllid.
  - HLB-infected trees dies.

- Discovered in Florida groves in August 2005:
  - Present in all 34 of FL’s citrus producing counties.
  - Eradication is no longer a possibility.

- Increasing reliance on disease management:
  - Control ACP through insecticides.
  - Tree nutrition programs to prolong productive life.
HLB incidence in Florida

% of Trees Infected with HLB

Source: Graham, Gottwald, Irey (2012).
Economic Impact of Greening

- Screen and Hodges (2012) estimated that between 2006/07 and 2010/11:
  - 8,000+ lost jobs
  - $4.5 billion loss in economic output

- Brown (2011) estimated that between 2004-2010, canker and HLB resulted in:
  - Loss of 14.4 million trees
  - $191 million in on-tree revenue
Contraction of Citrus Facilities

- # Processing Plants
- # Packing Houses

Source: FCPA/FDACS
Contraction of Citrus Industry

• Comparing 2011/12 to 2003/04 season:
  – The top 15 packinghouses ran 19% less fruit.
  – The top 7 processors ran 26% less fruit.

• Processor and Packinghouse operations are becoming more inefficient.
  – Running less than capacity.
  – More contraction/consolidation could ensue.
PRODUCTION TRENDS
Florida Orange & Grapefruit Bearing Trees

Source: Florida Agricultural Statistics Service.
Average Orange & Grapefruit Tree Density

Source: Florida Agricultural Statistics Service.
Average Orange & Grapefruit Tree Age

Source: Florida Agricultural Statistics Service.
Weighted Average Orange Acreage Yields

Pre-04/05 average EM yield 443 and standard deviation 35.

Post-07/08 average EM yield 385 and standard deviation 31.

Pre-04/05 average VAL yield 357 and standard deviation 42.

Post 04/05 average VAL yield 304 and standard deviation 36.

Source: Florida Agricultural Statistics Service.
Florida Orange Tree Planting and Loss Rates

Source: Florida Agricultural Statistics Service.
Summary of Production Trends

- Tree numbers across citrus varieties continue to decline over time.
- Tree mortality rates are higher than pre-hurricane levels but are stable in recent years.
- Average tree yields for OR and GF are lower than pre-2004 levels.
- New tree plantings remain at historically low levels (at about 50% of replacement for OR).
- The lack of new plantings has set the course for declining box production.
COST TRENDS
Production Background

Despite the recent high on-tree returns, the number of new trees remains very low in large part because of uncertainty.

Source: Florida Agricultural Statistics Service.
Total Citrus Grower Costs (2012 Dollars)

Source: Ron Muraro, Citrus Research and Education Center, Lake Alfred, UF.
Total Caretaking & Administrative Costs

$/PS

Freeze Event

Hurricanes, Canker, Greening
Total Pest Control Costs (2012 Dollars)
Total Fertilization Costs (2012 Dollars)
Summary of Cost Trends

• Total grove care costs continue to rise in the face of economic and disease pressures.

• Introduction of citrus greening in 2005, new management strategies while successful in mitigating disease losses have also lead to increased costs of production.

• Although on-tree returns are high, soaring costs result in higher break-even prices.
PRODUCTION PROJECTIONS
Tree Loss & Planting Rates

Then and now...

<table>
<thead>
<tr>
<th></th>
<th>1996-2000</th>
<th>2008-2012</th>
<th>Difference (over time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss rate</td>
<td>2.0%</td>
<td>3.5%</td>
<td>+1.5%</td>
</tr>
<tr>
<td>Planting rate</td>
<td>3.0%</td>
<td>2.0%</td>
<td>-1.0%</td>
</tr>
<tr>
<td>Difference (over rates)</td>
<td>+0.9%</td>
<td>-1.5%</td>
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</table>

- Loss rates have proportionately increased by 75%.
- Planting rates have proportionately declined by 34%.
- Only a modest positive wedge between losses and plantings is needed for setting the path towards a sustainable future!
Long-Range Production Methodology

- Project future citrus production by tree age using:
  - Assumed loss rates
  - Assumed planting rates
  - Apply average yields to projected acreage
- Use average between 2009-10 through 2011-12 season

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Loss Rate</th>
<th>Plant Rate</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where we are</td>
<td>3.5%</td>
<td>2.0%</td>
<td>-1.5%</td>
</tr>
<tr>
<td>Where we were</td>
<td>2.0%</td>
<td>3.0%</td>
<td>+1.0%</td>
</tr>
<tr>
<td>Where we don’t want to go</td>
<td>5.0%</td>
<td>1.0%</td>
<td>-4.0%</td>
</tr>
<tr>
<td>Where we are safe</td>
<td>3.0%</td>
<td>3.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Where we want to be</td>
<td>2.5%</td>
<td>3.0%</td>
<td>+0.5%</td>
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</table>
# Florida Orange Production Projections

<table>
<thead>
<tr>
<th>Season</th>
<th>Are Now</th>
<th>Were Then</th>
<th>Don't Want</th>
<th>Safe Place</th>
<th>Ideal</th>
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<tbody>
<tr>
<td>2006-07</td>
<td>129.0</td>
<td>129.0</td>
<td>129.0</td>
<td>129.0</td>
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<tr>
<td>2007-08</td>
<td>170.2</td>
<td>170.2</td>
<td>170.2</td>
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<tr>
<td>2008-09</td>
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<td>162.5</td>
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<td>2009-10</td>
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<td>133.7</td>
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<td>140.5</td>
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<tr>
<td>2011-12</td>
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<td>2013-14</td>
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<td>128.8</td>
<td>134.3</td>
<td>135.8</td>
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<td>2014-15</td>
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<td>2015-16</td>
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<td>122.6</td>
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<td>136.9</td>
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<tr>
<td>2016-17</td>
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<td>119.0</td>
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<td>137.2</td>
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<td>2017-18</td>
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<td>115.6</td>
<td>133.5</td>
<td>138.0</td>
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<td>2018-19</td>
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<td>112.2</td>
<td>133.5</td>
<td>138.8</td>
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<td>139.7</td>
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<td>147.5</td>
<td>105.3</td>
<td>133.7</td>
<td>140.5</td>
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<td>149.2</td>
<td>101.8</td>
<td>133.8</td>
<td>141.4</td>
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<td>2022-23</td>
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<td>150.9</td>
<td>98.4</td>
<td>133.9</td>
<td>142.2</td>
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<td>2023-24</td>
<td>120.0</td>
<td>152.6</td>
<td>95.0</td>
<td>134.0</td>
<td>143.1</td>
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<tr>
<td><strong>avg loss</strong></td>
<td>3.5</td>
<td>2.0</td>
<td>5.0</td>
<td>3.0</td>
<td>2.5</td>
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<tr>
<td><strong>avg plant</strong></td>
<td>2.0</td>
<td>3.0</td>
<td>1.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Florida Orange Production Projections

- Are Now
- Were Then
- Don't Want
- Safe Place
- Ideal

Millions of boxes

- 2006-07
- 2007-08
- 2008-09
- 2009-10
- 2010-11
- 2011-12
- 2012-13
- 2013-14
- 2014-15
- 2015-16
- 2016-17
- 2017-18
- 2018-19
- 2019-20
- 2020-21
- 2021-22
- 2022-23
- 2023-24
Summary of Production Projections

- Production projections for 2023-24 vary between 95.0 – 152.6 million boxes
- Three key factors impact production levels and are held constant in these projections.
  - Mortality rates (2% - 5%)
  - Planting rates (1% - 3%)
  - Yields (fixed at 3-year average)
- These factors, however, vary over time and can impact future production positively or negatively.
- Minor “course correction” on losses and plantings can promote positive change!
DISEASE RESEARCH
Tactical vs. Strategic

• **Scope of management options:**
  – Expand nurseries
  – Enhance budwood supply
  – Promote increased plantings

• **Scope of scientific agenda**
  – Minimize losses
  – Cost-efficiency
HLB Strategies

• **Short-Run Management Tactics**
  - Citrus Health Management Areas (CHMAs)
  - Tree therapy programs:
    - Foliar nutrient spray programs
    - Thermal heat therapy
    - Antimicrobial compounds
  - Tolerant rootstocks/scions (breeding programs)

• **Long-Run Solution Strategies**
  - Resistant varieties
  - Genetically modified HLB-resistant tree
NOT THE END OF ORANGE JUICE

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Photographs by Great Delta
Concluding Remarks

Long-run industry sustainability requires reduced tree mortality, increased tree plantings & market growth:

– Reduced mortality involves sustained efforts to control the psyllid; the application of current/future research to maintain tree health & HLB resistance.

– Increased plantings will be influenced by on-tree prices high enough to attract investment and an expectation that trees will survive to generate returns over time.

– Scope of research agenda to enhance productive efficiency through loss minimization via cost-efficient solutions.
Thank You!

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