Advanced Citrus Planting Systems for HLB Management: **Grove Design**

Bill Castle
Citrus Research and Education Center
University of Florida
Do you know this person?

Precision agriculture specialist, Ste. Michelle Wine Estates, Washington

Picking Winners
A Washington grower uses precision agriculture to harvest premium winegrapes, pg. 8
Manifest Density

Economist says it’s become clear Northwest pear growers must intensify orchard design.

By David Eddy
Senior Western Editor

deddy@meistermedia.com
Traditional pear orchards, such as the block of Anjou on the left, only allow for 200 to 300 trees per acre. However, more densely planted orchards (the block of Anjou on the right is spaced at 9 feet by 12 feet) allow close to 900 trees per acre. The end result, according to Oregon State University ag economist Clark Seavert, should be not just higher yields, but higher quality and, ultimately, higher profits.
Washington Tree Fruit Research Commission

“The Technology Roadmap for Tree Fruit Production”

• “For the U.S. tree fruit industry to compete globally, we must reduce the cost of production of its highest quality fruit by 30% by the year 2010.”

• Goals met by reducing labor, use of platforms [i.e., “pedestrian” orchards].

• robots

• “We need orchard designs that will take full advantage of technology.”
Where are we today?

• 576,577 acres.
• Tree density – 140 to 200 trees/acre;
• Modern grove is ca. 10 x 20 ft = 218 trees/acre.
• Average 08-09 **ORANGE** yield was ca. 350 boxes/acre.
• Average **GRAPEFRUIT** yield was ca. 480 boxes/acre.
• Average **MANDARIN** yield was 350 boxes/acre.

黄龙病
Where do we want to be tomorrow?

• High yield.
• Modern grove of 218 trees/acre or MORE!
• Better returns, sooner.
• HLB management.

黄龙病
Tree “factory” green space

1 acre
Grove Design

Grove design is a matter of maximizing what you can and accepting optimizing when necessary.
Who’s Engaged in this Concept?

• SWFREC, Immokalee
• Gapway Grove, Auburndale
• Harold McTeer, Dundee
• Gardinier, Indiantown
• A. Duda & Sons, Inc., LaBelle
• CPI, Immokalee
• Lykes Bros., Inc. Sebring
# SWFREC, Immokalee Trial

<table>
<thead>
<tr>
<th>Spacing</th>
<th>Density</th>
<th>Bed width</th>
<th>Rows per bed</th>
<th>Rootstock</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 x 10</td>
<td>545</td>
<td>48 feet</td>
<td>4</td>
<td>Flying Dragon</td>
</tr>
<tr>
<td>10 x 22</td>
<td>198</td>
<td>44 feet</td>
<td>2</td>
<td>Swingle</td>
</tr>
<tr>
<td>12 x 24</td>
<td>151</td>
<td>48 feet</td>
<td>2</td>
<td>Cleo and Volkamer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Emitters</th>
<th>Frequency</th>
<th>Number</th>
<th>Fertigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>OHS Drip</td>
<td>2-4 drippers/tree</td>
<td>Multiple daily</td>
<td>1-6</td>
<td>Daily</td>
</tr>
<tr>
<td>OHS Microsprinkler</td>
<td>2x8 pattern</td>
<td>Once daily</td>
<td>1</td>
<td>Weekly</td>
</tr>
<tr>
<td>Conventional Microsprinkler</td>
<td>360 degree</td>
<td>Weekly</td>
<td>1-3</td>
<td>Monthly</td>
</tr>
</tbody>
</table>

- **Hamlin**
  - Micro OHS
  - Drip OHS
  - Conventional

- **Valencia**
  - Micro OHS
  - Drip OHS
  - Conventional

The diagram shows the layout of the trial with different treatments and their respective distributions across the beds.
<table>
<thead>
<tr>
<th>Trmt</th>
<th>Spacing ft</th>
<th>Rootstock</th>
<th>Irrigation</th>
<th>Fertilization</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10x20</td>
<td>Swingle</td>
<td>Drip</td>
<td>OHS §</td>
<td>pulse irrig</td>
</tr>
<tr>
<td>2</td>
<td>10x20</td>
<td>Swingle</td>
<td>Drip</td>
<td>OHS+OM †</td>
<td>pulse irrig</td>
</tr>
<tr>
<td>3</td>
<td>10x20</td>
<td>Swingle</td>
<td>Microsprinkler</td>
<td>Gran ‡</td>
<td>grower irrig</td>
</tr>
<tr>
<td>4</td>
<td>10x20</td>
<td>Swingle</td>
<td>Microsprinkler</td>
<td>OHS</td>
<td>daily irrig</td>
</tr>
<tr>
<td>5</td>
<td>8x18</td>
<td>Swingle</td>
<td>Drip</td>
<td>OHS</td>
<td>pulse irrig</td>
</tr>
<tr>
<td>6</td>
<td>8x18</td>
<td>C-35</td>
<td>Drip</td>
<td>OHS</td>
<td>pulse irrig</td>
</tr>
<tr>
<td>7</td>
<td>8x15</td>
<td>C-35</td>
<td>Drip</td>
<td>OHS</td>
<td>pulse irrig</td>
</tr>
</tbody>
</table>

§ Open Hydroponics System - intensive, frequent liquid fertigation to supply all nutrients
† Organic matter as 4-5 lb of composted manure placed at the drippers
‡ Conventional granular fertilizer applied under the canopy

Ridge Experiment
# Gardinier Trial, Indiantown

40 acres

<table>
<thead>
<tr>
<th>Scion</th>
<th>Rootstock</th>
<th>Spacing</th>
<th>Trees/acre</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamlin</td>
<td>Swingle C-35</td>
<td>10 x 20</td>
<td>218</td>
<td>60-ft beds</td>
</tr>
<tr>
<td>Valencia</td>
<td>Willits citrange</td>
<td>8 x 20</td>
<td>272</td>
<td>3,4 rows/bed</td>
</tr>
<tr>
<td></td>
<td>Flying Dragon TF US 897</td>
<td>8 x 12</td>
<td>454</td>
<td></td>
</tr>
</tbody>
</table>
Financial Analysis - Valencia

10 x 22
• Yield year 10 – 450 boxes
• Year 5 – first positive cash flow
• Year 9 – Positive cum. income + investment; Yr 10 = $4,483.

ROI – 7%

8 x 12
• 800 boxes
• Year 4 – first positive cash flow
• Year 7; at Year 10 = $23,944

ROI – 20%
The GeoSpider Concept

• An over the top system.
• GeoSpider will serve as the tractor with a universal mounting and hydraulic power system for various implements:
  – Canopy shaker
  – Multi-arm harvester
  – Sprayer
  – Hedger/mulcher
  – Mower
  – Backhoe
  – Transplanter (resets)

Fig. 1 Geo-Spider Basic Layout

Patent Pending by GeoSpider, Inc.
Can a new system work? Vernia/size-controlling rootstock; age 4 years; 2.9 boxes.
Conclusions

• You MUST match scion and rootstock vigor and site conditions with spacing.
• Currently, tree densities between 200 to 300 trees/acre represent a comfort zone.
• Trees 6-9 ft tall at maturity.
• Sustained production of 600-800 boxes/acre.
• Less certain about performance of groves > 300 trees/acre. Requires new equipment.

bcastle@ufl.edu