Evolution of Sweet Cherry Production Systems

• Continuous Evolution
  – Naturally a tall tree
  – Moderate size pruned tree
  – Highly structured fruiting system

• Only since Gisela Rootstocks in 1990’s has the system evolved
Pluses and Minuses of High Density

- Early bearing
- High yields
- Increased tree efficiency
- Fruit quality?
- Early return on investment and breakeven cost
- High establishment cost
- Training and labor
- Level of knowledge
- Frost?
- Lifespan?

*Slide adapted from Musacchi & Lang*
Current Definitive Text, 2005

Rootstocks for Sweet & Sour Cherries,
pages 127-163

No Less than 45 + Rootstocks or Series of Rootstocks
Search of 12 U.S. Nursery Web Sites

- Colt
- Gisela 3
- Gisela 5
- Gisela 6
- Gisela 12

- Krymsk 5
- Krymsk 6
- Mahaleb
- Maxma 14
- Mazzard
- MxM 60
Numerous studies have shown that cherry production is dependent upon localized:

✓ Climate
✓ Site
✓ Soils
✓ Cultivar-Rootstock combination
Ideal Rootstock

• Compatibility
• Cold hardiness
• Uniformity in size control
• Flowering and fruiting habit
• Lack of root sucker production
• Virus susceptibility
Compatibility with scion

• Mazzard is compatible with all known sweet cherry cultivars.
• Mahaleb has been shown to be incompatible with some cultivars.
  – Tieton, Chelan,
• Weiroot 13 incompatibility problems
• Colt incompatible with Sam or Van
Cold Hardiness

- Concern mainly with late fall or early winter freezes
- Mahaleb acclimates earlier than Mazzard
- Gisela parents are both hardier than Mazzard
CHERRY ROOTSTOCK SIZE COMPARISON

*Gisela® rootstocks sizes are different for East Coast and West Coast.

- Mazzard
- Mahaleb
- MxM® 60
- Gisela® 12 (West)
- Gisela® 6 (West)
- Gisela® 12 (East)
- Gisela® 6 (East)
- Gisela® 5 (West)
- Gisela® 5 (East)
Relative Size Differentials

• Degree of growth control may vary by cultivar
  – Bing/Gi.12 < Bing/Gi.6
  – Regina/G.12 > Regina/Gi.6

• Location
  – Gi.6 in East ~ 60% seedling
  – Gi.6 in West ~ 90% seedling
Mazzard

• *Prunus avium*
  – The ORIGINAL rootstock
  – Largest of those available
  – Susceptible to crown gall & bacterial canker
  – Tolerance to *Phytophthora*
  – Not precocious
  – F 12/1 clone?
  – Vegetatively propagated seedlings
Mahaleb

*Prunus mahaleb*

More sensitive to wet soils
Better for calcareous soils
More cold hardy than Mazzard
Withstands drought better
Works well with all sweet varieties
Seedling selections
Gisela® Series

- Developed at Justus Leibig University in Giessen Germany
- Gi.3, Gi.5, Gi.6, Gi.7, Gi.12 were released
- Size control ranges from 45 to 90% of Mazzard
Gisela®3

• Most dwarfing ~30-35% Mazzard
• Only for best soils + irrigation
• Best suited for very high density
• Initial growth is vigorous then slows once fruiting begins
• Use in protected culture
• Does not sucker
• Must be supported
Gisela 5

- 40 – 50% of Mazzard
- Initially there were problems because it was not handled properly and stopped growing
- Can set excessive crop load resulting in small fruit on heavy yielding cultivars
- Sensitive to replant problems
- Does not like heat
Gisela 6

- Approximately 80% to 90% of Mazzard in West ~60% of Mazzard in East
- Forms new shoots easier than Gi.5
- Susceptible to bacterial canker?
- Suitable for 300 – 500 trees/A
- May need support
Gisela 12

- Tested as Gi.195/2
- About 50 – 60% of Mazzard in East
- Good virus resistance
- Of Gisela series has the best anchorage
- Does not sucker
Hedelfingen tree size, number of rootsuckers and percent size of Mazzard 7th leaf

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>TCSA Fall 04 (sq cm)</th>
<th># Suckers</th>
<th>% of Mazzard</th>
</tr>
</thead>
<tbody>
<tr>
<td>GI 209-1 (Gisela 3)</td>
<td>28.9a</td>
<td>4.0ab</td>
<td>24.4</td>
</tr>
<tr>
<td>GI-148-2 (Gisela 5)</td>
<td>40.4a</td>
<td>0.0a</td>
<td>34.2</td>
</tr>
<tr>
<td>GI-148-3 (Gisela 7)</td>
<td>48.5ab</td>
<td>19.5c</td>
<td>41.0</td>
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<tr>
<td>Weiroot 53</td>
<td>50.8abc</td>
<td>1.0ab</td>
<td>43.0</td>
</tr>
<tr>
<td>Wieroot 72</td>
<td>55.2abc</td>
<td>2.0ab</td>
<td>46.7</td>
</tr>
<tr>
<td>Edabriz</td>
<td>69.0abc</td>
<td>2.4ab</td>
<td>58.4</td>
</tr>
<tr>
<td>GI 195-20</td>
<td>78.7abc</td>
<td>0.6bc</td>
<td>66.6</td>
</tr>
<tr>
<td>GI-148-1 (Gisela 6)</td>
<td>80.9abc</td>
<td>0.6bc</td>
<td>68.4</td>
</tr>
<tr>
<td>Weiroot 13</td>
<td>108.7bc</td>
<td>6.5bc</td>
<td>92.0</td>
</tr>
<tr>
<td>Weiroot 158</td>
<td>111.7bc</td>
<td>10.5bc</td>
<td>94.5</td>
</tr>
<tr>
<td>Mazzard</td>
<td>118.2bc</td>
<td>0.3ab</td>
<td>100.0</td>
</tr>
<tr>
<td>Mahaleb</td>
<td>140.5c</td>
<td>0.0a</td>
<td>118.9</td>
</tr>
<tr>
<td>Weiroot 10</td>
<td>142.0c</td>
<td>11.2bc</td>
<td>120.2</td>
</tr>
</tbody>
</table>

P-value   0.0001   0.0001
NC-140 Rootstock x System Trial
NC-140 Rootstock x System Trial
Krymsk Rootstocks

- Originated near Black Sea in Russia
- Should be cold hardy (?)
- Propagated by softwood cuttings
- Krymsk 5 & 6 suitable for cherry
- Virus sensitivity issues
- Semidwarfing
  - K.5 ~ Gi,6 or Gi.12
  - K.6 ~ Gi.5
Krymsk cont.

- Krymsk 5 aka VSL-2
- Krymsk 6 aka LC-52
- May do better in heavier or wetter soils
- Needs more testing
Rootstock trial Regina

Gisela 5  Krymsk 5

From J. Vercammen, Belgium
FIGURE 1 – RELATIVE TREE SIZE OF SWEETHEART GROWN ON FOUR ROOTSTOCKS AND TRAINED TO THREE SYSTEMS AS EXPRESSED BY TRUNK CROSS SECTIONAL AREA (CM²).
FIGURE 3 – AVERAGE PER TREE FOURTH THROUGH SIXTH LEAF YIELD OF THREE VARIETIES COMBINED WITH FOUR ROOTSTOCKS.
Maxma 14

- Open pollinated Mahaleb seedling
  - Mahaleb x Mazzard $\rightarrow$ Ma x Ma = Maxma
- Semidwarf?
  - Depending upon soil strength
- More popular in France
- Needs annual appropriate pruning
- Some resistance to *Phytophthora*
MxM 60

- Mahaleb x Mazzard
- Resistance to *Phytophthora*
- Not precocious
- Very vigorous
- Not much planted in eastern U.S.
F 12/1

- Vegetatively propagated selection of Mazzard
- Preferred in western OR due to bacterial canker
- Rootstock usually forms the trunk from the branch union down and the cultivar is budded onto each lateral branch
- Susceptible to crown gall
- More vigorous than Mazzard
Weiroot Series

- Wild tart cherry seedlings growing in Bavaria
- Propagated by softwood or semi-hardwood cuttings
- Some incompatibility with sweet cultivars
- Original releases were W.10, W.13, W.14
- Later releases were W.53 & W.72
- Require support
On the Horizon

• WeiGi series
  – Cross of Gi.5 with Weiroot 720
  – WeiGi.2, 1, 3, 4 (smallest to largest)

• Michigan State series
  – Tart cherry
Relative tree sizes for 9 commercial cherry rootstocks & the 5 MSU candidate cherry rootstocks

Gi 12, Mazzard, Colt
Maxma 14, Mahaleb

Gisela 6
Krymsk 5

Krymsk 6

Gisela 5

90+%
80-90%
60-80%
50-60%
40-50%
35-40%

Clinton
Lake, Cass
Crawford
Clare

Image courtesy A. Iezzoni

Penn State Extension
Hedelfingen Tree Size by Rootstock in 5th Leaf

- GI 209-1 (Gisela 3)
- GI-148-2 (Gisela 5)
- GI-148-3 (Gisela 7)
- Weiroot 53
- Wieroot 72
- Edabriz
- GI 195-20 (Gisela 12)
- GI-148-1 (Gisela 6)
- Weiroot 13
- Weiroot 158
- Mazzard
- Mahaleb
- Weiroot 10

Values in square cm. with different letters indicating significant differences.