Development in high density cherry orchard systems in Hungary and China 1988-2014

- Modified Brunner-spindle published in 1998
- Slender spindle (1998): concept, but step by step modified
- Hungarian Cherry Spindle, (2010)
- Cooperation in China P.R., Shaanxi province, Northwest Agriculture and Forestry University (NWA&FU)
  - introduction of cultivars
  - rootstock testing and introduction
  - improved nursery technology
  - testing orchard systems
Central leader: Modified Brunner-spindle

500-800 trees/ha

Rootstocks: semi-dwarf to vigorous depending on site

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- Sweet cherry slender spindle high density orchards for hand picking (central leader type); 1000 – 2500 trees/ha
- Rootstocks: dwarf to moderate vigour depending on site
Hungarian Cherry Spindle

- High density orchard system for continental climate, improved step by step:

# Hungarian Cherry Spindle

<table>
<thead>
<tr>
<th>Tree architecture</th>
<th>Central leader with long fruiting branches</th>
</tr>
</thead>
</table>
| Tree height and spacing | ~ 3.5 – 4 m height  
4.0 – 5.0 x 1.4 – 2 m; |
| Tree number/ha | 1000 – 1800 tree/ha |
| Rootstocks | Mahaleb, moderate vigorous (65 to 90%) |
| Yielding | Turning to bearing in 3-4th year, full crop: 15-20 t/ha |
| Harvest | 70% crop from ground, upper part from low picking stands |
| Advantages | Large yield, premium fruit quality.  
Low emission to environment, IP. |
Hungarian Cherry Spindle

Target orchard

- Yield: 20 t/ha
- 2 000 000 fruit/ha
- MFW: 10 g
- 1.25 m² LA / 1 kg fruit
- Total LA ≈ 30 000 m²/ha
- LAI ≈ 3.0
- 40 - 50 000 running m total length of fruiting branches
Elements of Hungarian Cherry Spindle

- Vigorous or moderate vigorous *Prunus mahaleb* selections from Hungary (see poster: Bujdosó and Hrotkó)
- Application of root pruning,
- Planting distance 4.5 – 5 m by 1.5-1.8 m (trees / ha),
- Long fruiting branches from the year 2
- Optimized leaf area and leaf gas exchange
- Water use
- Branching characteristics of young trees by using notching and BA application
## Rootstocks already tested and recommended in Hungary

<table>
<thead>
<tr>
<th>Rootstocks</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cema (C 500), Cemany (C2753)</td>
<td>4.5 – 5.0 x 2 m</td>
</tr>
<tr>
<td>SL 64, Bogdány</td>
<td>4.5 – 5.0 x 2 m</td>
</tr>
<tr>
<td>Magyar, SM 11/4, Brokforest (MaxMa 14) Brokgrow (MaxMa 97), Pi-Ku 1</td>
<td>4.0–5.0x1.4 –1.6 m</td>
</tr>
<tr>
<td>Weiroot 154, 158, Gisela 6</td>
<td>4.0 x 1.2 – 1.5 m</td>
</tr>
<tr>
<td>Edabriz, Gisela 5, Prob</td>
<td>4.0 x 1.0 – 1.2 m</td>
</tr>
</tbody>
</table>

Blue: mahaleb seedlings, Green: clonal mahalebs and hybrids, Black: P. cerasus, Red: Hybrids
Estimated growth vigour of rootstocks

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Development in the world cherry production
Leaf stomatal conductance on different rootstocks

Stomatal conductance of 'Vera' leaves on GiSelA 6 („vulnerable hydraulic system”)
Water use of sweet cherry estimated by sapflow measurements

Nutrient uptake and supply influenced by rootstocks

Conclusion:

- ’GiSelA 6’ root is efficient in uptake N, P, K, Zn, B and Mn but tend to Ca, Mg and Cu deficiency.
- *Prunus mahaleb* is efficient supplier of N, P, K, Ca, Mg, Fe, Cu but tend to develop Zn, B and Mn deficiency.

Future research tasks for development in cherry orchard systems

- Evaluation of rootstocks for different soil and climate,
- Study on shoot growth and branching characteristics,
- Optimized light interception and penetration into the leaf canopy,
- Estimate the water requirements, optimized water use efficiency,
- Nutrient uptake and nutrient use efficiency,
- Integrated plant protection, reduced emission of chemicals,
- Optimized technical efforts (labor, fuel, other industrial products).
# Top 5 in the world cherry production and market (sweet and tart in metric tons) (USDA, 2011)

<table>
<thead>
<tr>
<th>Country</th>
<th>Production</th>
<th>Import</th>
<th>Export</th>
<th>Domestic fresh use</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU 27</td>
<td>649,700</td>
<td>25,000</td>
<td>35,000</td>
<td>425,920</td>
</tr>
<tr>
<td>USA</td>
<td>404,660</td>
<td>20,000</td>
<td>60,000</td>
<td>194,225</td>
</tr>
<tr>
<td>Turkey</td>
<td>370,000</td>
<td>0</td>
<td>46,000</td>
<td>180,000</td>
</tr>
<tr>
<td>Iran* (estimated)</td>
<td>≈350,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>China P.R.</td>
<td>210,000</td>
<td>28,000</td>
<td>10</td>
<td>228,000</td>
</tr>
</tbody>
</table>
Prospects for cherry production in China

- China’s actual production ≈ 250,000 t/year, in majority for domestic use, rapidly increasing
- Plans for rapid area and production increase in Shaanxi: actual area 3300 ha.
- Nurseries: in Shaanxi 4 million trees /year : planting material for 1000-1500 ha intensive orchards/year.
Shaanxi
Area: 210,000 km²
Population: 38 million
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Northwest Agriculture & Forestry University experimental farm
Mahaleb rootstocks in Sanyuan cherry nursery, Shaanxi
GiSelA 6 rootstocks in Sanlian Nursery, Tong-chuan

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2 million cherry trees in San-yuan Nursery

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Research plots for comparison of training systems, NWA&FU
Sanlian Research Station, Tong Chuan City, Left: cherries in greenhouse, right: tall spindle
Sanlian Research Station, Tong Chuan City
Director Zhou, sweet cherry in greenhouse
Xixiang, Hanzhong county, cherry orchard in subtropical climate
Xixiang, center for cherry tourism: cherry blossom festival, pick it yourself programs
Thank you for your attention!