The influence of different cherry rootstocks on sweet cherry properties

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- **Sweet cherry plantation raising** – long-term and expensive investment

Production share of sweet cherries by region (2012-2016):
- Asia 44.2%,
- Europe 34.6%,
- America 19.4%

Serbia’s total yield in 2016:
- 17,385 t

Serbia’s area harvested in 2016:
- 3,705 ha
Sweet or wild cherry (*Prunus avium* L.)

- Area of natural distribution: Europe, Anatolia, Maghreb, and western Asia, from the British Isles south to Morocco and Tunisia, north to the Trondheim fjord region in Norway and east to the Caucasus and northern Iran, with a small isolated population in the western Himalaya

- Forest tree in its native environment
- In Serbia wild cherry populates oak, beech and hornbeam forests up to 1.500 m a.s.l. and belongs to the endangered species of forest trees
- Deciduous tree, growing to relatively tall heights ≥10 m, with a trunk up to 1.2 m in diameter
• High variability has been found in wild cherry natural germplasm
• Term 'Mazzard' refers to a selected self-fertile cultivar that is used as a seedling rootstock for fruiting cultivars
• Susceptible to drought, grows well on fertile, loose, deep and moderately humid soils
• High density orchard systems improve the low yields of traditional orchards
• Importance of grafting and scion-rootstock compatibility
• Size-controlling rootstocks – the introduction of dwarfing and semi-dwarfing cherry rootstocks
Main advantages of dwarfing and semi-dwarfing rootstocks: reduced tree size, precocity and high productivity

Most of sweet cherry plantations are raised on very vigorous rootstocks including ‘Mazzard’ (Prunus avium) and ‘Mahaleb’ (Prunus mahaleb)

Full-size rootstocks (‘Mazzard’, ‘Mahaleb’, ‘Colt’) – best suited to standard-density orchards

Dwarfing rootstock ‘Gizela 5’ - poor adaptability in semi-arid climate
Research aim: to propose sweet cherry rootstocks both drought tolerant and precocious

- Selection of potential dwarf genotypes in a frame of autochthonous cherry germplasm
- ‘Oblačinska’ sour cherry (Prunus cerasus) and ground cherry (Prunus fruticosa) genotypes were selected for further research
Plant material

• Rootstock selections were primarily collected from natural populations and orchards and further maintained at University of Novi Sad, Faculty of Agriculture Fruit Research farm, Novi Sad, Serbia

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Species, interspecific hybrid</th>
<th>Locality</th>
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<tbody>
<tr>
<td><strong>Controls</strong></td>
<td></td>
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<tr>
<td>‘Colt’</td>
<td>Prunus avium × Prunus pseudocerasus</td>
<td>Rimski Šančevi</td>
</tr>
<tr>
<td>‘Mahaleb’</td>
<td>Prunus mahaleb</td>
<td>Rimski Šančevi</td>
</tr>
<tr>
<td>‘Mazzard’</td>
<td>Prunus avium</td>
<td>Rimski Šančevi</td>
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<tr>
<td><strong>Ground cherry</strong></td>
<td></td>
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<tr>
<td>SV2</td>
<td>Prunus fruticosa</td>
<td>Fruška gora</td>
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<tr>
<td>SV5</td>
<td>Prunus fruticosa</td>
<td>Fruška gora</td>
</tr>
<tr>
<td>SV7</td>
<td>Prunus fruticosa</td>
<td>Fruška gora</td>
</tr>
<tr>
<td>SV8</td>
<td>Prunus fruticosa</td>
<td>Fruška gora</td>
</tr>
<tr>
<td><strong>‘Oblačinska’ sour cherry</strong></td>
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<tr>
<td>OV4 NC</td>
<td>Prunus cerasus</td>
<td>Nova Crvenka</td>
</tr>
<tr>
<td>OV5 NC</td>
<td>Prunus cerasus</td>
<td>Nova Crvenka</td>
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</table>
• Sweet cherry variety ‘Summit’ was grafted on all selected rootstocks
• Trees were planted at a spacing of 1.5 m within row and 4 m between rows, training system is Spindel
• Plantation is currently in the third vegetation
• The field trial was not irrigated, nor fertigation was applied
• Protective anti-rain covering systems, hail netting or bird barricades were not used
Standard (reference) rootstocks

• ‘Mazzard’
  High vigor, moderate productivity, lack of precocity. No cases of incompatibility with sweet cherry scions have been recorded. It does not perform well in poorly drained or wet soils.

• ‘Mahaleb’
  Slightly more precocious and slightly less vigorous than ‘Mazzard’. Drought-tolerant and extremely sensitive to water-logged soils. Incompatibility of some sweet cherry varieties was observed and this condition has been recorded up to six years after planting.

• ‘Colt’
  When irrigated, it produces a vigorous tree similar in size to ‘Mazzard’ with similarly low precocity. Sensitive to drouthgy soils and to cold winter temperatures. Susceptible to crown gall.
‘Oblačinska’ sour cherry (*Prunus cerasus*)

- Autochthonous and heterogeneous cultivar, an ecotype that was domesticated in Aleksandrovo, Serbia
- Low vigorous and suitable for dense planting
- Selection from the diverse gene pool of ‘Oblačinska’ sour cherry in Serbia is a continuous process undertaken by local growers
- It has been used for decades as a dwarfing rootstock for sweet and sour cherries in Serbia
- High compatibility with commercial varieties
- Induces the early production of flowers, consistently high fruit set and regular and heavy cropping
- Genotypes were selected as the result of positive clone selection within the range of its’ origin and the highest prevalence
Ground cherry (*Prunus fruticosa*)

- European ground cherry exists as a hedge or as shrubs in abandoned vineyards and villages in Serbia
- Clusters of European ground cherry are a part of the Middle European shrub community
- In Northern European areas, European ground cherry is resistant to winter frosts (temperatures down to –50°C) and drought, yields early and well
- Selection of genotypes was conducted based on noticed unique and rare properties important for the breeding objectives’ realization – individual positive selection
Cultivar ‘Summit’

- Variety was named in 1973 by Agriculture Canada, Research Station, Summerland, British Columbia
- It originated from the cross Van X Sam, made in 1957 (K. O. Lapins)
- Large fruits (9 g), roundish heart-shaped
- Fruit skin is dark red when fully ripe, shiny
- The flesh is juicy, sweet and of high quality
- Tree is vigorous, spreading to upright
- It is known for very low yields, non-precocious variety
- Susceptible to fruit cracking in rain
**Effect of the rootstock on sweet cherry fruit properties**

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Fruit weight (g)</th>
<th>Fruit height (mm)</th>
<th>Fruit width (mm)</th>
<th>Fruit thickness (mm)</th>
<th>Petiole length (mm)</th>
<th>Stone weight (g)</th>
<th>Mezocarp ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV2</td>
<td>8.42 ± 1.03&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>25.21 ± 1.24&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>26.88 ± 0.79&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>21.08 ± 1.17&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>33.27 ± 2.49&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.43 ± 0.06&lt;sup&gt;a&lt;/sup&gt;</td>
<td>94.94 ± 0.36&lt;sup&gt;de&lt;/sup&gt;</td>
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<tr>
<td>SV5</td>
<td>9.08 ± 0.57&lt;sup&gt;b&lt;/sup&gt;</td>
<td>25.86 ± 0.89&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>27.66 ± 0.57&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>21.13 ± 2.46&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>32.87 ± 2.47&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.41 ± 0.06&lt;sup&gt;a&lt;/sup&gt;</td>
<td>95.46 ± 0.61&lt;sup&gt;bc&lt;/sup&gt;</td>
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<tr>
<td>SV7</td>
<td>9.73 ± 0.79&lt;sup&gt;a&lt;/sup&gt;</td>
<td>25.94 ± 0.81&lt;sup&gt;a&lt;/sup&gt;</td>
<td>28.34 ± 1.07&lt;sup&gt;a&lt;/sup&gt;</td>
<td>22.48 ± 1.05&lt;sup&gt;a&lt;/sup&gt;</td>
<td>34.67 ± 2.13&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.40 ± 0.06&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>95.84 ± 0.62&lt;sup&gt;ab&lt;/sup&gt;</td>
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<tr>
<td>SV8</td>
<td>8.03 ± 0.57&lt;sup&gt;d&lt;/sup&gt;</td>
<td>24.81 ± 0.70&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>26.05 ± 0.75&lt;sup&gt;d&lt;/sup&gt;</td>
<td>20.72 ± 0.66&lt;sup&gt;c&lt;/sup&gt;</td>
<td>32.27 ± 2.69&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.39 ± 0.03&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>95.19 ± 0.30&lt;sup&gt;cd&lt;/sup&gt;</td>
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<tr>
<td>OV4 NC</td>
<td>8.41 ± 0.91&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>25.64 ± 0.75&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>26.65 ± 0.87&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>20.93 ± 1.29&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>32.89 ± 2.71&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.41 ± 0.08&lt;sup&gt;ab&lt;/sup&gt;</td>
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<td>27.36 ± 0.78&lt;sup&gt;b&lt;/sup&gt;</td>
<td>21.83 ± 1.24&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>33.67 ± 2.66&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.40 ± 0.04&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>95.58 ± 0.55&lt;sup&gt;bc&lt;/sup&gt;</td>
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<td>'Colt'</td>
<td>6.74 ± 0.41&lt;sup&gt;e&lt;/sup&gt;</td>
<td>23.18 ± 0.46&lt;sup&gt;e&lt;/sup&gt;</td>
<td>24.62 ± 0.67&lt;sup&gt;e&lt;/sup&gt;</td>
<td>19.66 ± 0.60&lt;sup&gt;d&lt;/sup&gt;</td>
<td>29.87 ± 2.50&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.36 ± 0.04&lt;sup&gt;bc&lt;/sup&gt;</td>
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<td>'Mahaleb'</td>
<td>8.87 ± 0.89&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>24.37 ± 0.85&lt;sup&gt;d&lt;/sup&gt;</td>
<td>27.20 ± 0.96&lt;sup&gt;bc&lt;/sup&gt;</td>
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<td>'Mazzard'</td>
<td>7.26 ± 1.13&lt;sup&gt;de&lt;/sup&gt;</td>
<td>22.91 ± 1.08&lt;sup&gt;e&lt;/sup&gt;</td>
<td>25.16 ± 1.56&lt;sup&gt;de&lt;/sup&gt;</td>
<td>21.37 ± 1.14&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>28.87 ± 3.40&lt;sup&gt;c&lt;/sup&gt;</td>
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</table>

* Values with the same letter are not significantly different at $P \leq 0.05$ (Duncan’s multiple range test)
• Total soluble solid (%): ‘Colt’ 17,55 ± 1,62 
  SV5  17,27 ± 0,71 
  ‘Mazzard’  14,82 ± 1,35

Conclusions
• Best results regarding fruit properties were observed on SV7 rootstock, followed by SV5 and OV5 NC selections.
• In general, investigated rootstocks selected from populations of ‘Oblačinska’ sour cherry and ground cherry have indicated greater potential regarding precocity and fruit quality.
• On-going study obtains fruit properties analysis combined with research on plant growth characteristics.
Thank you for your attention!

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