Intensive Sweet Cherry Production: Making Ideas Come True

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Trends in sweet cherry production

- Relatively high yields and good fruit quality
- Extensive character
- Stagnation on a global scale, due to:
  - big size trees
  - high and gradually increasing labor expenses
  - late fruiting
  - delayed pay-back of investments
  - diminishing profits
- Need for intensification
Intensive cherry production

- Smaller trees, denser orchards
- Early fruiting
- Higher yields and fruit quality
- Economy of labor, water, mineral nutrients and agrochemicals
- Small tree advantages:
  - harvesting and pruning – from the terrain
  - improved photosynthesis and fruit coloration
  - easier plant protection and cheaper protective covers
  - earlier pay-back of investments
- Higher initial investments
- High expertise required
- **Dwarfing and productive rootstocks**
Traits and “bottlenecks” of the dwarfing rootstocks

- tendency to overloading – poor growth – small fruit – stunt trees – dead trees

- suited to rainy climates and on fertile soils with good water holding capacity

- unadapted to drought conditions and on poor and light soils
  (Lang, 2000; Bujdosó et al., 2004; Bujdosó, 2006; Papachatzis, 2006; Jiménez et al., 2007; De Salvador et al., 2008; Godini et al., 2008; Gyeviki et al., 2008; Ster, 2008; Bujdosó and Hrotkó, 2009; Fajt et al., 2009; Hrotkó et al., 2009; Lichev and Papachatzis, 2009; Long, 2009; Cantin et al., 2010; James, 2010; Long and Kaiser, 2010; Long et al., 2011)

- critical factors:
  - pruning
  - water regime
  - mineral nutrition
Guiding postulations

- The intensive cherry production differs, almost thoroughly, from the traditional one regarding pruning, irrigation and fertilization.
- Microirrigation and fertigation are indispensable elements of the technology, and the fine tuning of irrigation and fertilization regimes is a requisite.
- The unsatisfactory results of dwarfing rootstocks under water scarcity and on poor and light soils come after disregarding the extremely high requirements concerning pruning, water regime and mineral nutrition of the trees grown intensively.
Water storage in the root zone 20 hours after the preceding drip irrigation under the same irrigation regime (Koumanov et al., 1998)

When the soil properties are disregarded, evaporative losses are capable to significantly decrease the net water amount extracted by trees, thus greatly reducing the quantity and quality of the fruit production.
Water storage depletion in the tree root zone 20 hours after the preceding drip irrigation (Koumanov et al., 1998)
Mineral content of soil solution between two fertigation doses (Bigarreau Burlat/Mazzard); 30 May – 16 June 2010

Drip irrigation

Depth, 10 cm

Microsprinkling

Depth, 30 cm

D-NO₃, mg L⁻¹

P₂O₅ & K₂O, mg L⁻¹

EC, cS m⁻¹; pH

N-NO₃, mg L⁻¹

P₂O₅ & K₂O, mg L⁻¹

EC, cS m⁻¹; pH

N-NO₃, mg L⁻¹

P₂O₅ & K₂O, mg L⁻¹

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EC, cS m⁻¹; pH
Mineral content of soil solution between two fertigation doses (Bigarreau Burlat/Mazzard); 7 – 23 June 2011

Дълбочина 10 cm

Дълбочина 30 cm

Дълбочина 50 cm

B.B./P.Av.-DI  B.B./P.Av.-MS
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- The intensive cherry production is actually a high technology; therefore, the research should be carried out by large groups of scientists with diverse expertise, complementing one another.
- The intensive cherry production is a technology of the precise agriculture, i.e. the modern equipment, the high and multivalent grower qualification and the strict execution of each operation are imperative.
Subjects of investigation at FGI

- **Scion-rootstock combinations:** planting distances, training and pruning, tree architecture, growth and yield.
  - **Cultivars:** Bigarreau Burlat, Bing, Hudson, Katalin, Kordia, Lapins, Nalina, Regina, Summit, Sunburst.
  - **Rootstocks:** Gisela 5, Camil, Damil, Inmil, Prunus Mahaleb and Prunus Avium (Mazzard).
Subjects of investigation at FGI

- **Scion-rootstock combinations**: planting distances, training and pruning, tree architecture, growth and yield.

- **Microirrigation (drip & microsprinkling)**: crop evapotranspiration, regulated deficit irrigation, spatial and temporal distribution of water and root extraction in the soil, rainfall efficiency.

- **Fertigation**: timing and doses, tree’s mineral nutrition, fertilizers migration and localization in the soil.

- **Herbigation**: efficiency, selectivity, duration of the effect, mobility in the soil, and persistency of the applied herbicides

- **Insectigation**: efficiency, translocation in soil and trees, impact on the soil micro-flora and fauna; pesticide residues in fruit and plant organs

- **transfer of viral infections and their impact on the plant productivity under microirrigation and chemigation**

- **Technology for intensive sweet cherry production**
Multipurpose microirrigation systems

V2-DI  Drip irrigation
- drippers – on 2 laterals
- distance – 1.0 m
- discharge – 4 L h⁻¹
- wetted strip – 2.0 m

V1-MS  Microsprinkling
- microsprinklers – deflection type
- distance – 1.0 m
- discharge – 25 L h⁻¹
- wetted strip – 2.0 m
Multipurpose microirrigation systems

**V4-Ctrl**  Non-treated control
- drippers – on 2 laterals
- distance – 1.0 m
- discharge – 4 L h⁻¹
- wetted strip – 2.0 m

**V3-Std**  Hand sprayer + Drip
- drippers – on 2 laterals
- distance – 1.0 m
- discharge – 4 L h⁻¹
- wetted strip – 2.0 m
access tubes – 4 plots, with 12, 15, 16 and 25 tubes

tensiometers
0.00 0.15 0.30 0.45 0.60 0.75 0.90

distance from the microsprinkler (m)

0.0
0.5
1.0
1.5
2.0

2.40m access tubes

tensionics
10, 30, 50, 70 and 90 cm

62.5-77.5 cm or 82.5-97.5 cm

tensiometers

15, 30, 45, 60, 75, 90 & 105 cm

neutron probe

10, 30, 50, 70 and 90 cm

23/06/2009

23/06/2009
Chemigation

Fertigation:
✓ Kristalon
✓ Labin
✓ Compo
✓ Ammonium nitrate

Herbigation:
✓ pendimetalin
✓ oxifluorofen
✓ diquat
Regulated deficit irrigation

Cumulative yield (2007-2010) on Gisela 5

Effect of irrigation rate on canopy volume
Cherry tree architecture

- **Part of the total fruit, %**
  - Wood age, years
  - Varieties: Sunburst, Regina, Kordia, Lapins, Katalin

- **Fruit mass, mm**
  - Number of leaves per fruit
  - Girdled vs. non-girdled shoots

- **Fruit size, mm**
  - Number of leaves per fruit
  - Girdled vs. non-girdled shoots
Our research team

- Kouman Koumanov – Fruitgrowing Institute – meliorations, fruitgrowing technologies
- Kolyo Kolev – Fruitgrowing Institute – fruitgrowing, training and pruning
- Georgi Kornov – Fruitgrowing Institute – fruitgrowing
- Irina Tsareva – Fruitgrowing Institute – agrochemistry, fertilization
- Zatya Rankova – Fruitgrowing Institute – herbology, weed control
- Veselin Arnaudov – Fruitgrowing Institute – entomology and phytopathology
- Snezhana Milusheva – Fruitgrowing Institute – virology
- Iliana Kozanova – Fruitgrowing Institute – toxicology, pesticide residues
- Stefan Shilev – Agricultural University, Plovdiv – soil microbiology
- Zhenya Ilieva – Institute of soil science, agrotechnologies and plant protection, Sofia – helmintology (nematodes)
- Ilian Ivanov – Plovdiv University „Paisiy Hilendarski” – organic chemistry
- Stoyanka Nikolova – Plovdiv University „Paisiy Hilendarski” – organic chemistry, pesticide residues
- Dimitar Bozhilov – Plovdiv University „Paisiy Hilendarski” – Ph.D. student
Thank you