Impact of Climate Variability and Change on Fruit and Vegetable Production and Viticulture

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Vegetable production in the Republic of Macedonia
- Protected Crops
  - Glass houses 250 ha
  - Plastic houses 10,000 ha
- Open field production
  - nearly 50,000 and decreasing
- Main crops

**Fresh vegetables export January-September 2009**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Export Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomato</td>
<td>47%</td>
</tr>
<tr>
<td>Cabbage</td>
<td>17%</td>
</tr>
<tr>
<td>Cucumber</td>
<td>13%</td>
</tr>
<tr>
<td>Pepper</td>
<td>14%</td>
</tr>
<tr>
<td>Other</td>
<td>9%</td>
</tr>
</tbody>
</table>

Total export 118,000 t 31.3 mil €
- Cultivation characteristics
  Labor intensive
  Small lots
  Limited number of crops cultivated
  Water saving irrigation technologies not applied
- Obstacles posed by climate changes

Lower yields
Shorter cropping periods
Lower produce quality
Possible solutions
Diversification of the production
Water saving technologies
Drought resistant varieties
- local landraces
- Breeding programs
Fruit production in the Republic of Macedonia
### Fruit production in the Republic of Macedonia

<table>
<thead>
<tr>
<th>Export of fruits 2007-2008</th>
<th>Quantities, (t)</th>
<th>(000 €)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>76981,3</td>
<td>11181,7</td>
</tr>
<tr>
<td>Plums</td>
<td>273,9</td>
<td>87,9</td>
</tr>
<tr>
<td>Quinces</td>
<td>0,1</td>
<td>0,0</td>
</tr>
<tr>
<td>Apricots</td>
<td>150,5</td>
<td>60,9</td>
</tr>
<tr>
<td>Cherries</td>
<td>978,2</td>
<td>509,1</td>
</tr>
<tr>
<td>Peaches</td>
<td>4495,7</td>
<td>1562,6</td>
</tr>
<tr>
<td>Plums</td>
<td>2324,6</td>
<td>564,9</td>
</tr>
<tr>
<td>Strawberries</td>
<td>68,4</td>
<td>22,6</td>
</tr>
<tr>
<td>Other berry fruits</td>
<td>1,6</td>
<td>0,2</td>
</tr>
<tr>
<td>Bluberrries</td>
<td>34,5</td>
<td>90,2</td>
</tr>
<tr>
<td>Kiwi</td>
<td>9,9</td>
<td>6,4</td>
</tr>
</tbody>
</table>
- **Main crops**

- **Apples (54.64%)**
- **Pears (5.7%)**
- **Plums (19.15%)**
- **Peaches (6.38%)**
- **Apricots (1.53%)**
- **Cherry (2.38%)**
- **Sour Cherry (3.15%)**
- **Strawberry (4.43%)**
- **Other (2.64%)**
- Cultivation characteristics

Semi-intensive orchards
In most cases without irrigation
Unsuitable variety structure
Rootstocks are not drought resistant
Yields below European average
Low quality of production
- Obstacles posed by climate changes

Intensive production is not possible without irrigation

In the last years protective nets for shading and hail protection are required.
Possible solutions

Alternative fruit species structure in some regions (olives, pomegranate, pistachio, figs, etc)

Adoption of new cultivation practices:
- Irrigation
- Protective nets

Variety and rootstock alternation
Grape production in the Republic of Macedonia
22,401 ha (2008)
70% - cultivars for vine production
30% - cultivars for table grape production
- Cultivation characteristics
Guyot training system (usually)
Bare space between the rows
- Climate changes promotes:
  Earlier ripening but also causes sunburns
  Drought during berry development reduces the size of individual berry
  Higher sugar content, low acidity
  Lower diseases incandescence during the summer period
  Faster progress during the phenological stages
- Climate changes promotes:

Possibility for establishment of new viticulture regions that would be competitive to the old ones
- Adaptation to climate changes
  Terroir (increase latitude, altitude and reduced exposure to sun)
  Cultivars – drought resistant or tolerant rootstocks
  Varieties – Breeding programs for new drought resistant varieties (lower sugar content, earliness, optimal duration of phenological phases).
- Soil and Canopy Management
Grass cover between the rows combined with irrigation
Protective nets
New training systems (lyre) – Optimal berry exposure
Conclusions

Strengthening of existing and initiation of new breeding programs

Introduction and adoption of new technologies