Soilless cropping systems for outdoor vegetable production

Clean, efficient and sustainable?

Janjo de Haan, Suzanne van Dijk, Joanneke Spruijt, Matthijs Blind and Annemarie Breukers
Growers initiated research
Growers Problems: Market requirements
Growers Problems: Labour availability and working conditions
Growers Problems: Soil quality and land availability
Deep Flow Systems
Lettuce and other planted leaf crops
Leek
Cauliflower
Sown leaf crops: baby leafs or spinach
Technical issues in development of DF-systems

- Disease control
  - *Microdochium panattonianum*
  - Yellow stripe virus *Potyviridae*

- Propagation of plants in combination with
  - Substrate type of plant plug
  - Transplanting plants
## Yield levels

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Soil bound</th>
<th>Deep flow system</th>
<th>Factor</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leek</td>
<td>65</td>
<td>286</td>
<td>4.4</td>
<td>tons/ha/year</td>
</tr>
<tr>
<td>Head lettuce</td>
<td>163</td>
<td>684</td>
<td>4.2</td>
<td>1 000 heads/ha/year</td>
</tr>
<tr>
<td>Spinach</td>
<td>52</td>
<td>229</td>
<td>4.4</td>
<td>tons/ha/year</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>21</td>
<td>40</td>
<td>1.9</td>
<td>1 000 heads/ha/year</td>
</tr>
</tbody>
</table>
Relative cost price

- capital goods
- land
- labour
- transport
- seed, fertilizers, pesticides, energy

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Leek</th>
<th>Head lettuce</th>
<th>Spinach</th>
<th>Cauliflower</th>
</tr>
</thead>
<tbody>
<tr>
<td>soil</td>
<td>25%</td>
<td>30%</td>
<td>20%</td>
<td>10%</td>
</tr>
<tr>
<td>DF</td>
<td>5%</td>
<td>5%</td>
<td>3%</td>
<td>30%</td>
</tr>
</tbody>
</table>

WAGENINGEN UR
For quality of life

PROEFTUIN ZWAAGDIJK

Ministerie van Economische Zaken, Landbouw en Innovatie

Productschap Tuinbouw
Water management and emissions

- Potentials for emission reduction are high
  - Goal of 50-70% reduction possible to reach
  - Exact estimations are difficult

### Focus point | Solution
---|---
• Pests and diseases | • ‘Vital systems’
• Mismatch nutrients | • Fertiliser choice
  • Na⁺ accumulation | • Water management
• Rainfall surplus management | • Cover the system
  • Water level management |
### Expected sustainability performance of DF-systems per crop

<table>
<thead>
<tr>
<th></th>
<th>Leek</th>
<th>Head lettuce</th>
<th>Spinace</th>
<th>Cauliflower</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PLANET</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy use / GHG emissions</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Water use</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Nutrient use and emission</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Pesticide use and emission</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Land use</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>PEOPLE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour need</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td><strong>PROFIT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profitability</td>
<td>0/-</td>
<td>0/-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Conclusions

- Vegetables can be grown sustainable on DF systems
  - Large production increase possible
  - Potential for large emission reduction
- Some technical problems still to solve
  - Energy use and GHG-emissions
  - Diseases
  - Propagation system
  - Further optimization of the system
Thank you for listening
Content

Problems in current production

New cropping systems

Profitability and sustainability

Conclusions
Research program

- **Objective**

  *Develop and implement sustainable and profitable new cultivation systems that can comply with EU-regulations for water quality*

- **Outdoor horticulture**

- **Duration 2009-2013**
  - Continuation in development

- **Cooperation between researchers, growers, advisors and suppliers**

- **Financed by government and growers**