New cultivation systems for outdoor vegetable production

Is Soilless Cultivation Profitable and Sustainable?

Janjo de Haan, Tycho Vermeulen, Joanneke Spruijt and Annemarie Breukers
Content

Current Crop Production

New Cropping Systems

Profitability and Sustainability

Conclusions
Growers Problems: Market requirements
Growers Problems: Financial Return
Growers Problems: Soil Quality
Societal Problems: Water Quality

Legend
Compliance N or P
- No EQS for P
- Not measured
- Compliant
- Non-compliant
- Water boards

Nitrate
- 0 - 25 mg/l
- 25 - 50 mg/l
- 50 - 100 mg/l
- > 100 mg/l

N and P surface water

N groundwater
Nitrate directive can not be realized within current cropping systems

**Nitrate concentration groundwater (mg/litre)**

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concentration</td>
<td>120±5</td>
<td>40±2</td>
</tr>
</tbody>
</table>

**Balance (euro/ha)**

<table>
<thead>
<tr>
<th></th>
<th>Experiment</th>
<th>Chem fert</th>
<th>Farm Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrate Balance</td>
<td>1000</td>
<td>600</td>
<td>1600</td>
</tr>
</tbody>
</table>
Growers initiated research
Research program

- **Objective**

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

- **Outdoor horticulture**

- **Duration:** 2009-2013

- **Execution:** Researchers, growers, advisors, suppliers

- **Financed by**
  - Government
  - Product boards of growers
  - Various other parties
Program activities

- Systematic design, testing and improving of cultivation systems
- Advice to growers who start with these systems
- Sustainability assessments
- Societal aspects
  - Consumer perspectives
  - Laws and regulations (Spatial planning)
- Together with growers, suppliers, government and NGO’s
First experiments in 2007
Deep Flow Systems
Lettuce and other planted leaf crops
Lettuce and other planted leaf crops
Lettuce and other planted leaf crops
Development DF-system leaf crops

- Disease control
  - Microdochium panattonianum
- Long term use nutrient solution
- Pesticide accumulation
- Composition plant plugs and position in floater
- Fertilization strategies
Leek
Cauliflower
Sown leaf crops: rocket leaf or spinach
Profitability and Sustainability

- Yields
- Profitability
  - Cost price
  - Profitability
- Labour demand
- Sustainability Planet
  - Pesticide use
  - Emission reduction
  - GHG-emissions
- Societal aspects
<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>170</td>
<td>684</td>
<td>4.0</td>
<td>1,000 heads/ha/year</td>
</tr>
<tr>
<td>Spinach</td>
<td>114</td>
<td>125</td>
<td>1.1</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

Soil, DF, Leek, Head lettuce, Spinach, Cauliflower
Labour demand

Leek
Hours/10 000 kg

Lettuce
Hours/10 000 pieces
Relative pesticide use

leek
head lettuce
spinach
cauliflower
Water management and emissions

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

<table>
<thead>
<tr>
<th>Focus point</th>
<th>Solution</th>
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<tbody>
<tr>
<td>• Pests and diseases</td>
<td>• ‘Vital systems’</td>
</tr>
<tr>
<td>•Mismatch nutrients</td>
<td>• Fertiliser choice</td>
</tr>
<tr>
<td>• Na⁺ accumulation</td>
<td>• Water management</td>
</tr>
<tr>
<td>• Rainfall surplus management</td>
<td>• Cover the system</td>
</tr>
<tr>
<td></td>
<td>• Water level management</td>
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</tbody>
</table>
Solutions for rainfall surplus management
## Overall sustainability

<table>
<thead>
<tr>
<th>Better</th>
<th>Proved</th>
<th>Indication</th>
</tr>
</thead>
</table>
| • Land use  
• Labour conditions  
• Pesticide use | • Nutrient & pesticide emissions  
• Adaptation to climate change  
• Water use | |
| Comparable | | • Labour hours  
• Profitability |
| To improve / worse | | • Energy use and GHG-emissions  
• Financial risks |
LEGE BAKKEN...

Waarom haal je die niet weg?

ANDERE MATERIALEN
VOOR DE WITTE BAKKEN

GENEERED PLASTIC

RECYCLED

WILGEN

RIET

BIJZEN
Communication and landscaping important
Laws and regulations: Spatial planning

- Current legislation impede the realization of new cultivation systems at large scale
- Municipalities/provinces have difficulties to follow new developments
  - Fear to loose control
- Communication of advantages of the systems important
  - Delineate the advantages of the system
  - Connect picture with regional challenges
- Accept that systems have to be concentrated in specific locations
Conclusions

- Vegetables can be grown well on DF systems
  - Some technical problems still to solve
- Potential for large emission reduction
- Large production increase needed for
  - Profitability
    - Bulk production yet not profitable
    - Development via niche markets
  - Sustainability
    - GHG-emissions
Further outlook

- Guidance of growers in implementing cultivation systems
- Further improvement of cultivation systems
  - Resilient systems
  - Closing cycles (water, nutrients, energy, materials)
- Dialogue with society
  - Communication on advantages
  - Adapting systems to wishes of society
Thank you for listening