LCA case study in Argentina: 
Including impacts from freshwater use for rapeseed production in arid zones

Stephan Pfister 1,
Luca De Giovanetti 1,2, Mireille Faist 2,
Alejandro P. Arena 3, Rainer Zah 2,
Stefanie Hellweg 1, Annette Koehler 1

1 IfU, ETH Zurich, Zurich, Switzerland.
2 LCAM, EMPA, Zurich, Switzerland.
3 UTN, Mendoza, Argentina.

Suitability for winter rapeseed
Inventory

- Reference systems: Swiss and German production (ecoinvent 2.0)
- Field survey and local expert judgments in the two regions
- Land use in Argentina
  - Reference state for land conversion
  - Yields (highly variable) at 6% moisture
  - Harvest efficiency
- Differences in inventories:
  - mainly water use in arid zones
  - to some extent in fertilizer application

Inventory: yields & land use

<table>
<thead>
<tr>
<th>Yield [kg/ha]</th>
<th>Transformation from arable [m²]</th>
<th>Transformation from meadow &amp; pasture [m²]</th>
<th>Transformation from meadow, intensive [m²]</th>
<th>Occupation [m²/a]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>2700</td>
<td>3.70</td>
<td>-</td>
<td>2.16</td>
</tr>
<tr>
<td>Ecoinvent 2.0</td>
<td>Switzerland, Organic</td>
<td>3.95</td>
<td>0.99</td>
<td>4.53</td>
</tr>
<tr>
<td>RER (Germany)</td>
<td>3413</td>
<td>2.09</td>
<td>0.85</td>
<td>2.69</td>
</tr>
</tbody>
</table>
Inventory: Water use

• Results from field research station near Mendoza

<table>
<thead>
<tr>
<th></th>
<th>times</th>
<th>m³/ha</th>
<th>m³/kg rape seed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil preparation</td>
<td>1</td>
<td>3'000</td>
<td>1.11</td>
</tr>
<tr>
<td>Irrigation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>River (water net)</td>
<td>5</td>
<td>3'750</td>
<td>1.39</td>
</tr>
<tr>
<td>Groundwater (well)</td>
<td>1</td>
<td>750</td>
<td>0.28</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>7'500</td>
<td>2.78</td>
</tr>
</tbody>
</table>

• Calculated water consumption: 1.39 m³/kg
  – Irrigation efficiency of 50%
  – Corresponds to expert judgments

Impact assessment of water consumption

• comprehensive method of water-use impacts according to Eco-indicator 99
  – Damage to resources, ecosystem quality and human health
  – Regionalization
Impact assessment of rape seed production

Rapeseed-based methyl ester
Insights

- Problematic water consumption in arid regions
- Impacts on ecosystem quality are of major concern
  - Land use & water use
- Relevance of regionalization
  - Uncertainties need to be consistently assessed

Thanks for your attention!

Contact: stephan.pfister@ifu.baug.ethz.ch