Chapter 7: Environmental effects/impacts of energy crops

Supply and energy use of lignocellulosic biomass
(6 ECTS) 3513129

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## SRF vs Agriculture

<table>
<thead>
<tr>
<th>Site</th>
<th>Year planted</th>
<th>Variety</th>
<th>Reference field crop</th>
<th>Sludge/Ash</th>
<th>Last harvest</th>
<th>Mineral fertilization</th>
<th>Soil texture (0-20 cm)</th>
<th>Biomass 2009</th>
<th>Previous use before SRC</th>
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<tbody>
<tr>
<td>Billeberga II</td>
<td>1994</td>
<td>Torhild</td>
<td>Cereals/rape seed</td>
<td>Y/N (3)</td>
<td>Annually</td>
<td>N</td>
<td>loam</td>
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<td>78021</td>
<td>Cereals</td>
<td>Y/N (3)</td>
<td>2007/2011 (5)</td>
<td>N</td>
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<td>Grass</td>
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<td>Jorr</td>
<td>Pea/Cereals</td>
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</table>
Relative differences between willow SRC plantations versus the reference. The values are the averages for all the locations of the different soil quality parameters investigated in topsoil (0-20 cm) and in subsoil (40-60 cm). Positive values represent higher observations of the studied parameter in the willow SRC plantations, in percentage (Dimitriou et al 2012, Bioenergy Research).
Impacts on soil

- C storage in soil organic matter is higher under SRC than under conventional agricultural crops

- Soil organic matter stability is higher under SRC than under conventional agricultural crops and supports C sequestration in the soil

- Cd concentrations in the soil under SRC are lower than under conventional agricultural crops (ca. 12% lower in topsoil)

- Sludge applications did not affect the above differences of Cd in topsoil
Figur 4 Interpolverade koppar och kadmiumhaltar (mg kg$^{-1}$) i Uppsala län, klassade utifrån 10-, 25-, 50-, 75- och 90-percentilen (anges inom parentes).
Impacts on water quality

\[\text{NO}_3^-\text{N (mg l}^{-1}\text{)}\]

\[\text{PO}_4^-\text{P (mg l}^{-1}\text{)}\]

\text{Reference}

\text{SRC}
Averages of NO$_3$-N and PO$_4$-P concentrations in the groundwater of all fields pooled together for willow SRC and reference fields for the whole experimental period (Dimitriou et al., Bioenergy Research, 2012).

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Impacts on water quality

- Leaching of $\text{NO}_3$-N in the groundwater is substantially lower from SRC
- Leaching of $\text{PO}_4$-P in the groundwater is slightly higher from SRC
- Leaching of $\text{PO}_4$-P in the groundwater was not correlated to sewage sludge applications
Impacts on water quality
Impacts on biodiversity
Impacts on biodiversity

Leave unplanted/uncultivated edge zones
Impacts of SRC cultivation on soil quality

- C sequestration
- Cd concentration
- pH, trace elements
- Soil erosion
- Bulk density
- P availability
- N availability

Langeveld et al., Assessing environmental impacts of short rotation coppice (SRC) expansion: model definition and preliminary results. Bioenergy Research, 5(3), 621-635
Impacts of SRC cultivation on water quality

NO3-N groundwater

Groundwater recharge

Surface runoff

PO4-P groundwater

Langeveld et al., Assessing environmental impacts of short rotation coppice (SRC) expansion: model definition and preliminary results. *Bioenergy Research, 5*(3), 621-635

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Environmental issues

Figure 17. Impacts of willow short rotation cultivation on different environmental and socioeconomic factors. The line compares a scenario with 20% of the area planted (catchment level) to a reference level with no plantations (bold line).