LCA as Decision Support Tool in the Food and Feed Sector: R&D Case Studies

R&D ACCOMPANYING ECOLOGICAL ASSESSMENT

Use of Assessment and Decision Making Tools

Fixed Costs and Environmental Burdens

Knowledge Costs for Elimination

Degrees of freedom
Variability
Possible savings
CASE STUDY I: LEMNA & HERMETIA

Fish Feed from Insects and Duckweed
CONCEPT OF LEMNA & HERMETIA

**Biogas plant**
- Production plant
- Hermetia
- (Heat)
- Electricity
- Waste management
- Organic waste
- Excrement
- Grinding
- Pelleting
- Water
- Nutrient solution
- Processing/ extraction
- Residues
- Grinding
- Mixing/Pelleting
- Fish feed
- Lemna + Hermetia
- Market

**Lemna**
- Production plant
- Hermetia
- (Heat)
- Electricity
- Waste management
- Organic waste
- Excrement
- Grinding
- Pelleting
- Water
- Nutritious
- Residues
- Waste fish
- Fish/Fishmeal
- Starch
- Proteins
- Fibres

**Aquaculture**
- Water
- Nutritious
- Sewage
- Recycling
- Fish/Fishmeal

**Hermetia products:**
- Dry or live feed, palm oil substitute etc.

**Lemna products:**
- Feed, biomass, extraction of starch, proteins, fibres

**Waste management**
- Organic waste
- Excrement
- Grinding

**Water treatment**
- Recirculation
- Fish/Fishmeal

**Processing/ extraction**
- Excrement

**Nutrient solution**

**Fish feed**
- Lemna + Hermetia
ENVIRONMENTAL ASSESSMENT OF INSECT FARMING

Primary energy demand

Land use

Water footprint

Greenhouse gas potential

- Cereal bran
- Secondary electricity from biogas plant
- Plastic (containers, nets etc.)
- Water
- Heat from biogas plant
- Building
- Transport
- Wastewater treatment
- Primary electricity from biogas plant
- Disinfection
- Sawdust
- Emission
1. Organic waste (approved as feed) instead of cereal bran: Reduction by > 50%

2. Excess heat considered as “waste”: Overall reduction up to 70%
ENVIRONMENTAL ASSESSMENT OF DUCKWEED BREEDING

Primary energy demand

Land use

Water footprint

Greenhouse gas potential

-20%  0%  20%  40%  60%  80%  100%

- Cleaning, water, Disinfectant
- Electricity from power grid
- Building
- Nutrient fertilizer
- Plant equipment
- Wastewater treatment

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ENVIRONMENTAL ASSESSMENT OF DUCKWEED BREEDING

Further optimization by:
- Use of insect faeces instead of artificial fertilizer
- Recirculation of nutrient-rich water
- Adaption of harvesting procedure

Electricity from biogas plant: Reduction by a factor of 2
HOLISTIC ENVIRONMENTAL COMPARISON

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Lemna (wt-%)</th>
<th>Hermetia (wt-%)</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pellet 1</td>
<td>50</td>
<td>50</td>
<td>Protein:fat 1:1</td>
</tr>
<tr>
<td>Pellet 2</td>
<td>30</td>
<td>70</td>
<td>High fat content</td>
</tr>
<tr>
<td>Pellet 3</td>
<td>70</td>
<td>30</td>
<td>High protein content</td>
</tr>
<tr>
<td>Control (Tilapia feed)</td>
<td></td>
<td></td>
<td>Protein:fat 2:1</td>
</tr>
</tbody>
</table>
CASE STUDY II: SMART PROTEIN
From Farm to Fork: The next generation of smart protein food

One of the most innovative plant-based projects

A collaboration of 33 partners from more than 20 countries

4 years duration (2020-2024)

A EU-funded research project (Horizon 2020) with a €9+ million budget
PLANT-BASED PRODUCTS TO BE PRODUCED

A circular economy will be created by upcycling side streams

Chickpeas, lentils, quinoa, fava beans

Novel protein products from plants

Yeast and fungi

New ingredients
FUNGAL BIOMASS: MYCOPROTEIN PRODUCTION FROM SIDE STREAMS

<table>
<thead>
<tr>
<th>Per kg mycoprotein</th>
<th>CMP</th>
<th>Promyc</th>
<th>Soy</th>
<th>Pulses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land use change (m²a)</td>
<td>0.002</td>
<td>0.69</td>
<td>3.8</td>
<td>5.5</td>
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<tr>
<td>Water use (l)</td>
<td>130</td>
<td>377</td>
<td>2500</td>
<td>6000</td>
</tr>
<tr>
<td>Climate change (kg CO₂ eq.)</td>
<td>0.84</td>
<td>1.14</td>
<td>1.49</td>
<td>0.68</td>
</tr>
</tbody>
</table>

Circular mycoprotein production (CMP): Mycoprotein production using side streams as a substrate.

Promyc: Mycoprotein production using new resources for substrate.
THANK YOU FOR YOU KIND ATTENTION

Questions? Get in touch with us!

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