ORGANOFINERY: A biorefinery for the production of organic protein-rich feed for monogastric animals

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THE NEED FOR ORGANIC PROTEIN-FEED

• Several challenges in the supply of organic protein feed for monogastric animals:
  • Difficulties to obtain organic soybeans, and at reasonable price.
  • Lack of legumes with the suitable amino acid profile.
  • The use of conventional feed in organic agriculture is to be totally forbidden from 2018.

• Europe needs to develop sustainable farming systems based on locally produced feeds.

► Extraction of proteins from green biomass in a green biorefinery concept.
THE ORGANOFINERY PROCESS

GREEN BIOMASS → Screw press → GREEN JUICE → Fermentation 38°C LAB

Screw press → PRESS CAKE

GREEN JUICE → BROWN JUICE → Separation

PRESS CAKE → BIOGAS

BROWN JUICE → ORGANIC PROTEIN CONCENTRATE

FERITILI-ZER → BIOGAS

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LABORATORY SCALE EXPERIMENTS

RED CLOVER

CLOVER GRASS

ALFALFA

OILSEED RADISH

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# FEEDING QUALITY IN DRY PROTEIN PRODUCT

## Essential amino acids for poultry

<table>
<thead>
<tr>
<th>g/kg DM</th>
<th>Arg</th>
<th>Cys</th>
<th>His</th>
<th>Ile</th>
<th>Leu</th>
<th>Lys</th>
<th>Met</th>
<th>Phe</th>
<th>Thr</th>
<th>Val</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soybeans</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td>31.4</td>
<td>5.8</td>
<td>10.1</td>
<td>18.5</td>
<td>29.3</td>
<td>26.2</td>
<td>5.2</td>
<td>19.7</td>
<td>15.6</td>
<td>18</td>
<td>179.8</td>
</tr>
<tr>
<td><strong>Red clover</strong></td>
<td>26.8</td>
<td>2.5</td>
<td>10.8</td>
<td>23.5</td>
<td>39.4</td>
<td>26.8</td>
<td>8.5</td>
<td>26.5</td>
<td>20.1</td>
<td>28.2</td>
<td>213.1</td>
</tr>
<tr>
<td><strong>Clover grass</strong></td>
<td>22.9</td>
<td>2.4</td>
<td>9.1</td>
<td>20.9</td>
<td>34.3</td>
<td>23.9</td>
<td>8.2</td>
<td>23</td>
<td>17.7</td>
<td>24.8</td>
<td>187.2</td>
</tr>
<tr>
<td><strong>Alfalfa</strong></td>
<td>20.1</td>
<td>3.4</td>
<td>9</td>
<td>21.8</td>
<td>35.4</td>
<td>21.5</td>
<td>7.8</td>
<td>25.5</td>
<td>17.6</td>
<td>24</td>
<td>186.1</td>
</tr>
<tr>
<td><strong>Oilseed radish</strong></td>
<td>23.4</td>
<td>4.7</td>
<td>10.1</td>
<td>21.7</td>
<td>37.3</td>
<td>25.4</td>
<td>9.1</td>
<td>25.3</td>
<td>19.2</td>
<td>26</td>
<td>202.2</td>
</tr>
</tbody>
</table>

<sup>a</sup>Steenfeldt and Hammershøj, 2015.
PILOT SCALE EXPERIMENT
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FRESH CLOVER GRASS
- 18% DM
- 18% CP (of DM)

PRESS CAKE
- 30% DM
- 16% CP (of DM)

GREEN JUICE
- 8% DM
- 24% CP (of DM)

PROTEIN CONCENTRATE
- 27% DM
- 32% CP (of DM)
PILOT SCALE EXPERIMENT

400 TONS
FRESHLY HARVESTED CLOVER GRASS

223 TONS
PRESS CAKE 56 %

177 TONS
GREEN JUICE 44 %

7 TONS
PROTEIN CONCENTRATE 2 %

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PILOT SCALE EXPERIMENT

- 4% of proteins in the fresh crop were recovered in the protein concentrate.

- Dry protein product contained 30-35% of proteins.

- Bottlenecks in the process:
  - Screw pressing.
  - Decanter centrifugation.

- Next steps:
  - Feeding trial with laying hens.
  - Feeding trial with pigs.
  - Press cake will be tested as cow feed (Bio-value).
CONCLUSIONS

- Organofinery process can produce organic protein-rich feed for monogastric animals.

- Efficient process at laboratory scale:
  - Up to 23% of proteins recovered in the protein concentrate from red clover.
  - Yields between 6kg and 13kg of dry organic protein product per ton of fresh crop.

- Several challenges to face at large scale:
  - Optimization of the screw pressing.
  - Improve the separation of proteins after the fermentation.

- Good practical experience, and stakeholders look forward the next steps for Organofinery to become a reality soon.
ACKNOWLEDGMENTS

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THANKS FOR YOU
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