PRODUCTION AND USE OF LEGUMES IN DENMARK – CHALLENGES AND PROSPECTS.

CAN CHANGED USE OF LEGUMES PROMOTE A MORE SUSTAINABLE / MORE ORGANIC AGRICULTURE?

Erik Fog

Berlin, November 4th 2016
OUTLINE

- Background
- Changes in the role of legumes
- Soy dominance – actual status
- Other legumes
- Legumes in organic farming
- Bio-refined protein from clover – a game-changer?
BACKGROUND

- **SEGES** the national innovation, business and service center for Danish agriculture.
- Part of **The Danish Agriculture and Food Council**
- Erik Fog, senior advisor on organic farming since 1987.
- Projects: Eco-Protein and OrganoFinery
THE ROLE OF LEGUMES

- First of all a protein source for animal feed
- Other positive characteristics: Nitrogen fixation, improvement of rotations.
- New interests in domestic production of proteins:
  - Minimizing the carbon footprint from animal feed
  - Avoiding GM-products in the feed
  - Less vulnerable to prize fluctuations in the world market
THE DOMINANCE OF SOYA PROTEIN

Danish consumption of crude protein in concentrates

mio. kg % soya

2000 100
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015

(Statistics Denmark)
## The Dominance of Soya Protein

<table>
<thead>
<tr>
<th>Feed source</th>
<th>% of total crude protein consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soya</td>
<td>39</td>
</tr>
<tr>
<td>Fish products</td>
<td>9</td>
</tr>
<tr>
<td>Rape cakes</td>
<td>7</td>
</tr>
<tr>
<td>Sunflower cakes</td>
<td>5</td>
</tr>
<tr>
<td>Pulses + dried Lucerne, Grass</td>
<td>2</td>
</tr>
<tr>
<td>Cereals</td>
<td>35</td>
</tr>
</tbody>
</table>

(Statistics Denmark)
CULTIVATION OF PULSES IN DENMARK

Hectares with pulses

- Faba beans
- Peas for combining
- Lupin

(Statistics Denmark)
LEGUMES ARE STILL MINOR CROPS

Legumes compared to total agricultural area

Agricultural land
Grass and clover
Pulses

(Statistics Denmark)
ECONOMIC VALUE OF FABA BEANS

Contribution margin per hectare

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter wheat</td>
<td>3.000</td>
<td>6.000</td>
</tr>
<tr>
<td>Spring barley</td>
<td>2.000</td>
<td>5.000</td>
</tr>
<tr>
<td>Faba beans</td>
<td>4.000</td>
<td>6.000</td>
</tr>
</tbody>
</table>

(Farmtal Online, SEGES)
ORGANIC FARMING IS PROMOTING LEGUME CULTIVATION

<table>
<thead>
<tr>
<th>2012-15</th>
<th>Organic (% of total area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural land</td>
<td>5,8</td>
</tr>
<tr>
<td>Grass and clover</td>
<td>36,6</td>
</tr>
<tr>
<td>Faba beans</td>
<td>62,4</td>
</tr>
<tr>
<td>Peas</td>
<td>28,5</td>
</tr>
<tr>
<td>Lupins</td>
<td>85,3</td>
</tr>
</tbody>
</table>

(Statistics Denmark)
MORE PRODUCTION NEEDED TO MEET THE DEMAND

Demand and production of grain legumes for organic livestock (2015)

- Ruminants
- Pigs & poultry
- Total demand
- Cultivated in DK

(SEGES)
# GRASS PROTEIN FOR MONOGASTRIC ANIMALS

<table>
<thead>
<tr>
<th></th>
<th>Field pea</th>
<th>Faba beans</th>
<th>Lupin</th>
<th>GC conc.</th>
<th>Soya</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Protein, % of dry matter</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>29</td>
<td>34</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td><strong>Amino acids, % of protein</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cystine</td>
<td>1,4</td>
<td>1,2</td>
<td>1,5</td>
<td>0,6</td>
<td>1,5</td>
</tr>
<tr>
<td>Lysine</td>
<td>7,2</td>
<td>6,3</td>
<td>4,7</td>
<td>5,9</td>
<td>6,2</td>
</tr>
<tr>
<td>Methionine</td>
<td>1,0</td>
<td>0,8</td>
<td>0,7</td>
<td>2,0</td>
<td>1,4</td>
</tr>
</tbody>
</table>

(SEGES)
# HIGH PROTEIN PRODUCTION IN GRASS CLOVER

<table>
<thead>
<tr>
<th></th>
<th>Grass clover</th>
<th>Faba beans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (Dry matter per ha)</td>
<td>14,0 tons</td>
<td>5,5 tons</td>
</tr>
<tr>
<td>Crude protein per ha</td>
<td>2,0 tons</td>
<td>1,5 tons</td>
</tr>
</tbody>
</table>

- Plus extra value from grass clover in:
  - Nitrogen for the succeeding crops
  - Carbon sequestration in the soil
  - Feed for cattle or biogas production

(SEGES)
GRASS CLOVER– THE NEW PROTEIN SOURCE
DEVELOPMENT OF BIO-REFINED GRASS PROTEIN

● Danish projects working on the production of protein from grass clover (cultivation, bio-refining techniques, feed value):
  ● OrganoFinery
  ● BioValue
  ● MultiPlant