Energy consumption in animal production, specific figures

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UH
Energy use

- Feed
- Water
- Concentrates
- Shelter
  - Heat
- Care
  - Ventilation
  - Illumination
- Heat
- Care
- Ventilation
- Illumination

- Meat
- Fat
- Bones
- Skin
- Manure
- Heat
- Water
Specific figures

- What is a specific figure?
- Specific figure is the same as functional unit
- What is a functional unit?
- We use units which is suitable for comparing production
- In milk production we can use:
  - Energy input/produced unit = J/kg milk
- In pork production we can use:
  - Energy input/produced unit = J/kg pork
- With specific (functional) units we can compare:
  - Different production inputs and their effects on production specific figures
  - Different farms
  - Different production types (traditional/organic)
  - Different countries

\( \text{J/kg} \)
Energy input/output

• Normal energy inputs are
  – Direct energy input
    • Fuels
    • Electricity
    • Feed
  – Indirect energy input
    • Some figures are hard to get, for instance building and machine manufacturing energy
    • The energies which are not included should at least mentioned that they are not included

• Energy outputs
  – Milk production
    • After utilizing the milk we will utilize also the meat, this is in most cases included
    • Cows produce also calves, this is also utilized
  – Pork production
    • Are skin and bones utilized, what is their energy content?
    • Is fat utilized, its energy content is very high
Feeding material

- Feeding material is either from own field productions or it is bought.
- Feeding material energy input figures can be:
  - heating values of the feed
  - feed production energy consumption figures
  - for concentrates figures found in literature
# Milk production

Source: Mikkola & Ahokas. Energy ratios in Finnish agricultural production

<table>
<thead>
<tr>
<th>Specific figure MJ/kg</th>
<th>Source</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,6</td>
<td>Mikkola &amp; Ahokas</td>
<td>Only feed production energy is included</td>
</tr>
<tr>
<td>3,2</td>
<td>Mikkola &amp; Ahokas</td>
<td>Feed production and housing (+machine) energy included</td>
</tr>
<tr>
<td>2,1 – 4,1</td>
<td>Gröönroos</td>
<td>Organic and conventional production in Finland</td>
</tr>
<tr>
<td>2,2 – 3,6</td>
<td>Refsgaard</td>
<td>Organic and conventional production</td>
</tr>
<tr>
<td>3,1 – 5,0</td>
<td>Thomassen</td>
<td>Organic and conventional farms in Netherlands</td>
</tr>
<tr>
<td>1,2 – 3,9</td>
<td>De Boer</td>
<td>Sweden, Netherlands, Germany</td>
</tr>
</tbody>
</table>
Milk production energy ratios

- Energy ratio = Output/Input
- 1 kg of milk = 3 MJ
- \( E = \frac{3}{3.2} = 0.9 \)
- Milk production is not energy positive, more energy is needed in the production than the product has!
Specific figure

1,6 MJ/kg  
E = 1,9

3,2 MJ/kg  
E = 0,9
Milk production efficiency

- Energy ratio in plant production. \( E = 3 - 5 \)
- Milk production efficiency 20 %
- Energy ratio in milk production 0,6 – 1,0 without any shelter
# Pork production

Source: Mikkola & Ahokas. Energy ratios in Finnish agricultural production

<table>
<thead>
<tr>
<th>Specific figure MJ/kg</th>
<th>Source</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 – 11</td>
<td>Mikkola &amp; Ahokas</td>
<td>Only feed production included</td>
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<tr>
<td>25 – 29</td>
<td>Mikkola &amp; Ahokas</td>
<td>Feed, machines and housing included</td>
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<tr>
<td>15,9 – 22,2</td>
<td>Basset-Mens &amp; van der Werf</td>
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</tr>
<tr>
<td>22</td>
<td>Cederberg &amp; Darelius</td>
<td></td>
</tr>
</tbody>
</table>
Pork production energy ratios

- Energy ratio = Output/Input
- 1 kg of meat = 9 MJ
- \( E = \frac{9}{27} = 0.33 \)
- Pork production is not energy positive, more energy is needed in the production than the product has!
Specific figure

10 MJ/kg  
E = 0.9

27 MJ/kg  
E = 0.3
This material has been produced in ENPOS project. ENPOS is acronym for Energy Positive Farm.

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• MTT Agrifood Research Finland - Agricultural Engineering
• Estonian University of Life Sciences

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