The effect of increased production efficiency in beef production

I. Cow population size

II. Greenhouse gas emissions

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Introduction

- A simulation study
  - production strategies to meet domestic demand for milk and beef towards 2030

- Background:
  ✓ Domestic milk quotas
  ✓ Import restrictions on milk and beef
  ✓ High annual increase in milk yield/dairy cow from $\Delta G/E$-improvements
    ⇒ decrease in dairy beef production

  ✓ To ensure domestic beef production to meet market demands:
    ⇒ increase in suckler beef production
    ⇒ undesirable due to increased greenhouse gas (GHG) emissions

- Key role: Annual milk yield/dairy cow

Project:
“Strategies in dairy and beef production for meeting the demand of food based on a climate- and cost efficient use of domestic feeds” (2013-2015).

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*The Foundation for Research Levy on Agricultural Products
*The Agricultural Agreement Research Fund
*The farmer cooperative industry partners: TINE SA, Nortura SA, NFK
The simulation - assumptions

- Four scenarios for production levels in 2030
- Within each scenario, three prognoses for increase in annual milk yield/dairy cow production
- Production statistics from official and livestock data bases for the year 2012
- 2012 population sizes:
  - 233,000 dairy cows
  - 70,000 suckler cows

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Milk (mill. litres)</th>
<th>Beef (tonnes)</th>
<th>Feed resource restrictions</th>
<th>Annual increase in milk yield/dairy cow (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1,500</td>
<td>110,000</td>
<td>no</td>
<td>2, 1, 0%</td>
</tr>
<tr>
<td>B</td>
<td>1,770</td>
<td>110,000</td>
<td>no</td>
<td>2, 1, 0%</td>
</tr>
<tr>
<td>C</td>
<td>1,770</td>
<td>110,000</td>
<td>yes</td>
<td>2, 1, 0%</td>
</tr>
<tr>
<td>D</td>
<td>1,230</td>
<td>80,000</td>
<td>no</td>
<td>2, 1, 0%</td>
</tr>
</tbody>
</table>

*) Milk yield are set by feed restrictions
Beef production from suckler cows

How will this influence GHG emissions?
GHG emissions

• Estimated using two farm scale models:
  – HolosNor (Bonesmo et al., 2013)
  – BEEFGEM (Foley et al., 2011)
GHG emissions

- GHG emissions (CH₄, N₂O and CO₂)
  - direct
    - on farm livestock production activities
  - indirect
    - inputs used on farm and nitrate leaching and volatilization

- GHG emissions calculated for the 4 scenarios and constant (1) or increased (2) beef production per cow
  - per kg milk and beef
  - total emissions from domestic milk and beef production
Assumptions

• Milk yield per cow
  – 2, 1 and 0% increase (except Scenario C)
  • no. of dairy cows to fulfill quota
  • use of feed (concentrate vs. roughage)
    – areas needed

• Beef production per cow:
  – dairy: 1) 250 and 2) 277 kg
  – suckler: 1) 275 and 2) 318 kg

Weather and soil data
Results
Emission intensities per kg beef

Emission intensities

<table>
<thead>
<tr>
<th>kg CO2-equivalents/kg beef</th>
<th>Dairy</th>
<th>Suckler</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15.3 (Constant)</td>
<td>25.6 (Increased)</td>
</tr>
<tr>
<td></td>
<td>14.4 (Increased)</td>
<td>21.7 (Increased)</td>
</tr>
</tbody>
</table>
Average emissions per kg beef

- Highest emissions per kg beef with 2% yield increase
- Lowest emissions with low yield (scenario C)
- Increased efficiency=lower emission intensity
GHG emissions from beef production

Effect of increased efficiency: -274’ tons CO₂-equivalents
Emission intensities for milk

- Increased yield reduces emissions
  - fewer dairy cows → reduced enteric methane and manure
  - reduced ley area → reduced soil N₂O and energy use
  - higher emissions from concentrates
Total emissions from milk and beef

- Increased efficiency: 6% of the total emission from agriculture (~4.4 mill. tons CO$_2$-eq.)

1500 mill. l milk
110' ton beef

1770 mill. l milk
110' ton beef

1230 mill. l milk
80' ton beef
Conclusions

• In a system with milk quotas:
  – annual milk yield per dairy cow determines the size of the dairy and suckler cow populations, and GHG emissions from milk and beef production
  – beef: lowest emissions with low milk yields per cow
    • high proportion of dairy beef
  – milk: lowest emissions with high milk yields
    • fewer cows to meet quota
  – small effects on total emissions

• Increased efficiency in beef production (dairy and suckler) reduces GHG emissions and is therefore an important mitigation option.
  – 6% of the emissions from agriculture

Thank you for your attention!