Economic assessment of greenhouse gas mitigation on livestock farms

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Vera Eory¹, Philippe Faverdin², Laurence Shalloo³, Donal O’Brien³, Nick Hutchings⁴, Marcia Stienezen⁵

¹SRUC, ²INRA, ³TEAGASC, ⁴Aarhus University, ⁵Wageningen UR

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Farm level assessment

- GHG, N: biophysical model (FarmAC)
- Finances: partial budgeting
- Farms:
  - Maritime grass-based dairy
  - Maritime grass-based beef
- Mitigation measures:
  - Reduced N fertilisation, grass-clover mix, improved pasture quality, longer grazing, nitrification inhibitors, improved genetics of dairy, earlier finishing of beef
FarmAC

Deposition Fixation Fertiliser Manure

NO₃ → CO₂ → NH₃, N₂O, N₂ → Storage losses

NH₃, N₂O, N₂ → Runoff

CH₄, CO₂

NH₃, N₂O, N₂ → Exported

CH₄, CO₂

Exported

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## Farms’ description summary

<table>
<thead>
<tr>
<th></th>
<th>Maritime dairy</th>
<th>Maritime beef</th>
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</thead>
<tbody>
<tr>
<td>Farm size [ha]</td>
<td>35.2</td>
<td>47.2</td>
</tr>
<tr>
<td>Grazed pasture [ha]</td>
<td>21.8</td>
<td>24.5</td>
</tr>
<tr>
<td>Grass silage [ha]</td>
<td>13.4</td>
<td>22.7</td>
</tr>
<tr>
<td>Number of cows [head]</td>
<td>66</td>
<td>35</td>
</tr>
<tr>
<td>Urea used [kg N/yr/farm]</td>
<td>2,532</td>
<td>0</td>
</tr>
<tr>
<td>CAN used [kg N/yr/farm]</td>
<td>2,686</td>
<td>3,211</td>
</tr>
<tr>
<td>Concentrate imported [kg DM/y/farm]</td>
<td>49,126</td>
<td>27,978</td>
</tr>
<tr>
<td>Grass silage imported [kg DM/y/farm]</td>
<td>1,851</td>
<td>-7,087</td>
</tr>
</tbody>
</table>
## Financial data summary

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<table>
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<tbody>
<tr>
<td>Urea price [EUR(2011)/t N]</td>
<td>878</td>
</tr>
<tr>
<td>CAN price [EUR(2011)/t N]</td>
<td>1,185</td>
</tr>
<tr>
<td>Concentrate price [EUR(2011)/t fresh matter]</td>
<td>284</td>
</tr>
<tr>
<td>Grass silage price [EUR(2011)/t fresh matter]</td>
<td>30</td>
</tr>
<tr>
<td>Reseeding cost [EUR(2011)/ha]</td>
<td>250</td>
</tr>
<tr>
<td>Clover seed price [EUR(2011)/kg]</td>
<td>8</td>
</tr>
<tr>
<td>DCD price [EUR(2011)/kg]</td>
<td>7</td>
</tr>
<tr>
<td>Milk price [EUR/kg]</td>
<td>0.345</td>
</tr>
<tr>
<td>Average heifer/steer price [EUR/kg LW]</td>
<td>1.9</td>
</tr>
</tbody>
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Mitigation option assumptions

- **Reduced N fertilisation**
  - -5% synthetic N, -4-6% grass yield, +3-4% forage utilisation
  - No technical cost

- **Grass – clover mixture (7-10% clover)**
  - -16% synthetic N, same grass yield, +4% milk yield/growth rate
  - Seeding cost €8/ha/y, no change in reseeding frequency

- **Improving pasture quality through better management**
  - Increased digestibility (assuming rotational grazing), +2% milk yield/growth rate
  - Reseeding frequency increased

- **Improved genetics (dairy farm only)**
  - +5% milk yield/growth rate
  - No technical cost (assumption: artificial insemination in the baseline)

- **Earlier finishing (beef farm only)**
  - -8% synthetic N,
  - No technical cost

- **Nitrification inhibitors**
  - -9% synthetic N, 10kg/ha/y DCD, +2% milk yield/growth rate
  - DCD cost €17/ha/y

- **Longer grazing (+5 days)**
  - -0.5% synthetic N, +1% milk yield/growth rate
  - No technical cost
Beef farm

Typical Irish Beef Farm

Mitigation costs [EUR 2011/Yr] vs. GHG emission change [\% of baseline]

Mitigation costs [EUR 2011/Yr] vs. GHG emission intensity change [\% of baseline]

Legend:
- 0-Baseline
- 1-ReducedN
- 2-Clover
- 3-PastureQuality
- 4-EarlierFinishing
- 5-Nitification
- 6-LongerGrazing
- 7-IncreasedN
- 8-EarlierFinish_LongerGrazing
- 9-Clover ReducdN

[Graphs showing mitigation costs vs. emission changes for different scenarios.]
Dairy farm
Comparison with other studies

Conclusions

• Emission intensity or absolute reduction?
  – Currently mixed policy messages

• Mitigation by individual options are low
  – Need for “packages”

• Most of the selected measures have negative costs (technical costs only!), though many implies improved management practice
  – Barriers (time/effort of implementation, perceived risk of reduced yield, lack of information/trust)
  – Framing the message: focus on efficiency and profitability

• Both implementation and effects are different on different farms
  – Information/advice should be farm-specific as much as possible
Thank you!

vera.eory@sru.ac.uk