Economic assessment of greenhouse gas mitigation on livestock farms

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Assessment of mitigation options

• Where to reduce emissions, which pathways to choose?
• Aspects
  – **Economic**: At what cost? How efficient?
  – **Distributional**: Who loses, who gains?
  – **Environmental**: How much mitigation? Are there any negative or positive co-effects?
  – **Institutional**: Transaction costs? How to monitor?
Marginal abatement cost curves

• Economic rationale

• How do they help?
  – Identify the most cost-effective ways of meeting the targets – within and between sectors
  – Identify options that cost less than the a C price

Pearce and Turner 1989
Farm level assessment

• AnimalChange project: farm level biophysical modelling on farms across Europe
• Mitigation options selected by farm experts
• Economic assessment on two farms (so far):
  – Maritime grass-based dairy (Irish national average farm)
  – Maritime grass-based beef (Irish national average farm)
Agronomic and cost assumptions

• Reduced N fertilisation
  – -5% synthetic N, -4-6% grass yield, +3-4% forage utilisation
  – Scenario with silage import

• Grass – clover mixture (7-10% clover)
  – -16% synthetic N, same grass yield, +4% milk yield (growth rate)
  – Seeding cost €8/ha/y, same reseeding frequency

• Improving pasture quality through better management
  – Increased digestibility, +2% milk yield (growth rate)
  – Reseeding frequency increased

• Improved genetics
  – +5% milk yield (growth rate)
  – No cost (assumption: artificial insemination in the baseline)

• Nitrification inhibitors
  – -9% synthetic N, +2% milk yield (growth rate)
  – DCD cost €17/ha/y

• Longer grazing (+5 days)
  – -0.5% synthetic N, +1% milk yield (growth rate)
Results: CE, EI, GHG mitigation

Irish National Average Dairy Farm

Irish National Average Beef Farm

GHG emission intensity [kg CO2e/kg protein]

GHG cost-effectiveness [EUR(2011)/t CO2e]

GHGmit
- 0.1%
- 0.2%
- 0.6%
- 1.2%
- 2.2%
- 4.1%

GHGmit
- 0.5%
- 1.0%
- 1.6%
- 3.1%
## Sensitivity analysis of CE (dairy)

<table>
<thead>
<tr>
<th></th>
<th>Reduced N</th>
<th>Clover</th>
<th>Pasture quality</th>
<th>Genetic improvement</th>
<th>Nitrification inhibitors</th>
<th>Longer grazing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea price</td>
<td>41%</td>
<td>7%</td>
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<td>-10%</td>
<td>0%</td>
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<tr>
<td>CAN price</td>
<td>59%</td>
<td>10%</td>
<td></td>
<td></td>
<td>-15%</td>
<td>1%</td>
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<tr>
<td>Reseeding frequency</td>
<td>-3%</td>
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<tr>
<td>Reseeding cost</td>
<td></td>
<td>44%</td>
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<tr>
<td>DCD price</td>
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<td>125%</td>
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<tr>
<td>Milk price</td>
<td>87%</td>
<td>102%</td>
<td>100%</td>
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<td>98%</td>
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<td>Beef cattle price</td>
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</table>
Results: other pollutants

Irish average dairy

Irish average beef

Reduction in emission intensity

Increase in animal protein exported

NH3 mitigation

N leaching mitigation

GHG mitigation

Reduction in emission intensity

Increase in animal protein exported

N leaching mitigation

GHG mitigation

Increased in animal protein exported

Reduction in emission intensity

Irish average dairy

Irish average beef

Reduced N

Clover

Pasture quality

Genetic improvement

Nitrification inh.

Longer grazing

CLIMATE-SMART Agriculture 2015
Comparison with other studies

![Graph showing cost-effectiveness in EUR/tCO2e across different categories: Reduce N, NI, Clover, Genetics. The graph compares various studies and includes a carbon price line at 100.]
Conclusions

• Most of the selected measures are “win-win” considering technical costs, many implies improved management practice

• Both implementation and effects are different on different farms

• Potential barriers: lack of information, time/effort of implementation, perceived risk of reduced yield

• Policy instruments:
  – Voluntary (information, financial risk reduction)
  – Information/advice should be farm-specific
  – Framing the message: focus on efficiency and profitability
  – Regulatory instruments for the consistently win-win measures
  – Market-based solutions?
Thank you!

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Additional slides
## Results: summary

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<thead>
<tr>
<th></th>
<th>Irish average dairy</th>
<th>Irish average beef</th>
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<tr>
<td><strong>GHG mitigation</strong></td>
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<tr>
<td><strong>Unit</strong></td>
<td>t CO2e/farm/y</td>
<td>t CO2e/farm/y</td>
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<tr>
<td><strong>Reduced N</strong></td>
<td>4.0</td>
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<tr>
<td><strong>Clover</strong></td>
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<td><strong>Pasture quality</strong></td>
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<td><strong>Genetic improvement</strong></td>
<td>0.6</td>
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<td><strong>Nitrification inhibitor</strong></td>
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<td><strong>Longer grazing</strong></td>
<td>2.0</td>
<td>1.3</td>
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<td><strong>GHG mitigation %</strong></td>
<td>1.2%</td>
<td>1.0%</td>
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<tr>
<td><strong>BAU</strong></td>
<td>4.1%</td>
<td>1.6%</td>
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<td><strong>Animal protein exported %</strong></td>
<td>0.0%</td>
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<td><strong>change from BAU</strong></td>
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<td>-0.3%</td>
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<td><strong>Total cost EUR(2011)/farm/y</strong></td>
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<td><strong>GHG CE EUR(2011)/t CO2e</strong></td>
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