Priorities for the European R&D agenda with regard to sustainable intensification in dairy farming

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Structure of presentation

- Definitions and scope
- Drivers and challenges to the EU dairy industry
- Perspectives on sustainability
- Role of science and technology
- Priorities for research and development
- Summary and conclusions in relation to sustainable intensification
Some definitions

‘Sustainable intensification’
- ‘producing more outputs with more efficient use of all inputs – on a durable basis – while reducing environmental damage and building resilience, natural capital and the flow of environmental services’ (Royal Society, 2009)
- i.e. producing more, while impacting less (on finite resources of fossil, fuel, fertiliser, water, land; on GHG emissions; eutrophication, biodiversity)

‘The 3 pillars of sustainability’

Priorities for ‘Research and Development (and Innovation)’
Societal challenges impacting on agriculture

- Food security
- Efficient resource use (incl. reducing waste)
- Environmental protection
- Climate change impact
- Socially acceptable systems of livestock production
- Economic development
  ↓↓
- Sustainable production and consumption
Global dairy markets (2010 - 20)

- World trade to grow from 50m to 85m tonnes
- Demand expected to match or exceed production
- Consumption growth
  - < 1% in traditional markets (EU, Japan, Oceania)
  - 2% in North & Central America
  - 3% China, India & Sub-Saharan Africa
- Competitiveness, and purchasing power, will dictate EU potential to export

<table>
<thead>
<tr>
<th>Number of global middle class (m)</th>
<th>2010-12</th>
<th>2020</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>OECD countries</td>
<td>200</td>
<td>202</td>
<td>203</td>
</tr>
<tr>
<td>Countries outside the OECD area</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>N. America</td>
<td>338</td>
<td>333</td>
<td>322</td>
</tr>
<tr>
<td>Europe</td>
<td>664</td>
<td>703</td>
<td>680</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>525</td>
<td>174</td>
<td>322</td>
</tr>
</tbody>
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Source: OECD
Not just supply - wider societal interest in...

Nutrition & health

Environmental impact

Production system

Grazing dairy cows in North-West Europe
Economic farm performance and future developments with emphasis on the Dutch situation
Scale and diversity in EU dairy farming (EU 27)

- 1.0 million dairy farmers
- 50 million hectares of land
- 23 million dairy cows
- 140 billion litres per annum
- 24% of total world dairy output

<table>
<thead>
<tr>
<th></th>
<th>Ireland</th>
<th>GB</th>
<th>Poland</th>
<th>Slovakia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Av. yield (l)</td>
<td>5365</td>
<td>7827</td>
<td>5075</td>
<td>6024</td>
</tr>
<tr>
<td>Av. herd size</td>
<td>55</td>
<td>137</td>
<td>4</td>
<td>164</td>
</tr>
<tr>
<td>No. of dairy farms</td>
<td>13100</td>
<td>14400</td>
<td>656500</td>
<td>1100</td>
</tr>
</tbody>
</table>
End of quota 2015

- Total EU output expected to grow by 2%-3% per annum
- Volatility in output (and input) prices will create pressure
- Significant differences between regions; mountain regions, areas of Northern & Central Europe more at risk

**Convergence of milk price**  
**Long-term decline in farmer no**

![Graph of milk price convergence and long-term farmer numbers decline](image_url)
Contexts for sustainable dairy production
Land sparing vs land sharing
(US dairy herd output 1944 vs. 2007)

Today's herd can produce 1b kg milk, with:-

- 21% of the animals
- 35% of the water
- 10% of the land
- 24% of the manure
- 43% of the methane
- 56% of the nitrous oxid
- 37% of the carbon footprint

(From Capper et al, 2009)
Carbon footprint of high performing grass-based & confined systems

<table>
<thead>
<tr>
<th></th>
<th>Grass based</th>
<th>Confined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Irish</td>
<td>UK</td>
</tr>
<tr>
<td>Milk production (kg per cow per year)</td>
<td>6262</td>
<td>10892</td>
</tr>
<tr>
<td>Milk production (kg ECM per cow)</td>
<td>6695</td>
<td>10602</td>
</tr>
<tr>
<td>Stocking rate (Livestock Units/ha)</td>
<td>2.53</td>
<td>3.74</td>
</tr>
<tr>
<td>Concentrate input (kg per cow per year)</td>
<td>320</td>
<td>2905</td>
</tr>
<tr>
<td>CO₂ eq/t ECM – C sequestration included</td>
<td>837</td>
<td>884</td>
</tr>
<tr>
<td>CO₂ eq/t ECM – no C sequestration</td>
<td>914</td>
<td>895</td>
</tr>
</tbody>
</table>

With sequestration included, the grass-based system had 5%-7% lower CO₂ footprint than average herds. Top performing herds were 27%-32% lower in CO₂ footprint than average herds.
Appliance of science

- Plant & animal genetics
- Precision agriculture
- Telemetry/sensing technology
- ‘Big data’
- Decision support tools
- Product innovation
Also, the ‘appliance of sense’

- Ensuring fundamentals
- Farm and system-specific solutions
- Key questions
  - context
  - application
  - and cost benefit

Detection of oestrus using ultra wide band technology
Appliance of better management approaches

- E.g. Dairy Lean Management
- Continuous improvements in production efficiency achieved through maximising value creation, and minimising generation of waste.
Recommended R&D priorities – Animal Task Force

ATF White Paper, Apr. 13

1st Addendum, Nov. 14
Sustainable intensification - top 6 priorities for research and development

Efficient and resilient feed supply
  – Autonomy in protein supply
  – Greater exploitation of forage components in the diet
  – Optimal use of co-products/non-human edible feedstuffs

Efficient, healthy animals
  – Genetic improvement for fitness traits (fertility, longevity, disease resistance/resilience)
  – Feed efficiency (adapted to system and type of diet)
Sustainable intensification - top 6 priorities for research and development

Nutrient management (encompassing soil health)
- Improved nutrient management, recovery and delivery systems
- Plant breeding for improved nutrient efficiency

Further development of robust LCA methodologies
- Sustainability characteristics and outcomes of different methods of production
- Valorise ecosystem services from diverse production systems
Sustainable intensification – top 6 priorities for research and development

Consumer-friendly production systems
- Design of housing systems to better meet cow comfort and behavioural needs

Socio-economic traction
- New business models to improve infrastructure & facilitate entry of younger generation into dairying
- Tools and tactics to increase farm resilience to climate and/or economic shock
- Data & systems to increase visibility on local issues & priorities to influence behaviour on sustainable production
Summary and conclusions

• Competitiveness, improved resource efficiency, environmental performance and social responsibility key to a sustainable future for dairy farming in Europe

• ‘Sustainable intensification’ is compatible with these goals – when interpreted in its widest context

• Mixed delivery model needed to take account of regional structural, environmental and socio-economic differences

• R&D can provide understanding of biological processes, enabling technologies and technical innovations