LIFETIME PERFORMANCE IS KEY TO SUSTAINABLE DAIRY PRODUCTION

Irmgard Immig, Sr Manager Global Technical Services Ruminants
GASL Manhatten Kansas, Sept, 9th, 2019
9.7bn 2050

70%

more animal based food within the planet’s boundaries
Ruminants play a key economic & ecological role to achieve this

- Ruminants turn non-edible products into high nutritious food
- Ruminants use marginal lands to produce high nutritious food
- Ruminants are a key component to socio-economic status

World’s land area 13 bn ha
Agricultural land 4.9 bn ha
Pasture & meadow 3.5 bn ha
Arable land 1.4 bn ha

The dairy cow dilemma – increased feed & replacement costs

80% of the world's population consume dairy products

100% increases in milk production during the last 50 years

30% Increase in milk production between 2005 and 2015

Cost of milk production

- Feed 65%
- Replacement 22%
- Water, electricity, vet, AI & other 13%

Reproductive problems 19%
Poor production 26%
Mastitis & udder 16%
Lameness 16%

Source: IFCN, 2012
Replacement rates increase and cow longevity decreases globally - a major issue affecting sustainability

<table>
<thead>
<tr>
<th>Country</th>
<th>Replacement rate (%)</th>
<th>Parity of cows (number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norway</td>
<td>25%</td>
<td>4.5</td>
</tr>
<tr>
<td>Denmark</td>
<td>30%</td>
<td>4</td>
</tr>
<tr>
<td>France</td>
<td>35%</td>
<td>3.5</td>
</tr>
<tr>
<td>Germany</td>
<td>40%</td>
<td>3</td>
</tr>
<tr>
<td>Italy</td>
<td>45%</td>
<td>2.5</td>
</tr>
<tr>
<td>Ireland</td>
<td>50%</td>
<td>2</td>
</tr>
<tr>
<td>US</td>
<td>20%</td>
<td>4</td>
</tr>
<tr>
<td>Australia</td>
<td>10%</td>
<td>1</td>
</tr>
<tr>
<td>New Zealand</td>
<td>5%</td>
<td>0.5</td>
</tr>
<tr>
<td>Japan</td>
<td>15%</td>
<td>2.5</td>
</tr>
<tr>
<td>China</td>
<td>20%</td>
<td>2</td>
</tr>
<tr>
<td>Brazil</td>
<td>25%</td>
<td>1.5</td>
</tr>
<tr>
<td>Mexico</td>
<td>30%</td>
<td>1</td>
</tr>
<tr>
<td>Argentina</td>
<td>35%</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Source: IFCN, 2017

- Reproductive performance is declining about 1%/year
- Farm profitability depends on cow’s lifetime performance.
- Multiparous cows produce up to 20% more milk than heifers.
- This is critical to address for sustainable dairy farming
Lack of pasture and over-reliance on preserved feed

Intensive dairying moving cows more inside, lower access to pasture, more by-products and preserved forages (silage, hay) mean a lack of essential micro nutrients (β-Carotene & E) - vital for reproductive success, udder health, immunity and stress resistance.

There is a need for non-medicated and preventative supplements.
Lack of vitamin E results in lower resistance to mastitis with substantial impact on farm economics & food waste

23% of cows are culled early in life due to mastitis & udder health

$32 billion estimated annual mastitis cost to the global dairy industry

33% typical clinical mastitis incidence in high producing herds

31% is loss of milk production

18% is discarded milk (Food Loss & Waste)

Source: Santman-Berends et al., 2015
Nutrient utilization drives farm economics

Feed costs contribute to 65% to the total milk production costs. Feed cost savings - key drivers for profitable dairy farming

Corn has a high nutritional value - is good fiber and energy source, but not all is digested.

<table>
<thead>
<tr>
<th>Typical starch intake in early lactation @ 6.8 kg/cow/d</th>
<th>Starch losses via feces (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Starch losses (g DM/cow/d)</td>
<td>335</td>
</tr>
<tr>
<td>Extra corn grain required to substitute fecal starch loss (g/cow/d)</td>
<td>543</td>
</tr>
<tr>
<td>€/cow/day</td>
<td>0.09</td>
</tr>
</tbody>
</table>

1) 70% starch in corn grain, 88% DM
2) Costs of corn grain 164 €/t
The impact of improved corn utilization on land use and resources is significant

20 MIO EUROPEAN COWS OVER 100 DAYS

5% lower starch excretion

3 mio t corn silage

210 000 ha corn

1.5 mio t wheat

2.7 bln loaves of bread
**Get more out of corn based dairy diets**

*Amylase enzyme reduces nutrient excretion*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>No Amylase</th>
<th>Amylase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk yield (kg/cow/d)</td>
<td>35.4</td>
<td>37.0</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>3.34</td>
<td>3.59</td>
</tr>
<tr>
<td>Casein (%)</td>
<td>2.55</td>
<td>2.63</td>
</tr>
<tr>
<td>Preg Rate (%)</td>
<td>21.0</td>
<td>26.6</td>
</tr>
<tr>
<td>Feed efficiency (%)</td>
<td>1.49</td>
<td>1.55</td>
</tr>
</tbody>
</table>

Ration in kg FM/hd/d: Corn meal 6.5, corn flakes 2, protein blend 4.5, soybean full fat 0.8, alfalfa hay 7.0, grass hay 1st cut 5.5, molasses 1.0. Constituents in %: CP 16.74, NDF 29.19, Starch 24.04, by-pass starch 1.88 kg
**Human activities are a driver of climate change**

14.5% of Green House Gasses originate from livestock sector

**The cow’s footprint presents a major challenge**

<table>
<thead>
<tr>
<th>Animal Type</th>
<th>Emissions (mT CO2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef Cattle</td>
<td>2,495</td>
</tr>
<tr>
<td>Dairy Cattle</td>
<td>2,128</td>
</tr>
<tr>
<td>Pigs</td>
<td>686</td>
</tr>
<tr>
<td>Buffalo</td>
<td>618</td>
</tr>
<tr>
<td>Chickens</td>
<td>672</td>
</tr>
<tr>
<td>Small Ruminants</td>
<td>474</td>
</tr>
<tr>
<td>Other Poultry</td>
<td>72</td>
</tr>
</tbody>
</table>

~66% of livestock emissions

14.5% of Green House Gasses originate from livestock sector.
Productivity improvements are key to reductions in GHG emissions & nitrogen flows to the environment

Without productivity gains GHG emissions would have risen 38% between 2005 and 2015 instead of 18%

The 18% increase in GHG emissions between 2005 and 2015 was attributable to

169 million tons CO₂ equiv. coming from methane from enteric fermentation & manure decomposition

52 million tons CO₂ equiv. coming from N₂O....

....of which a large contributor is excess dietary nitrogen excreted in manure & urine

Source: FAO, Global Dairy Platform, Rome 2019
Addressing the methane issue

3-NOP is a radical innovative & disruptive technology that significantly reduces methane emissions from ruminants.

It enables the consistent reduction of methane emissions.

30% minimum reduction in methane emissions, helping improve the sustainability of the dairy industry.
Recognized the potential impact of reducing enteric methane from ruminants

Intense collaboration among scientists, dairy and beef sector/value chain, external partners and experts in nutrition, biology, chemistry, engineering and analytics

Peer-reviewed studies have shown that 3-NOP has the ability to consistently reduce enteric methane by -30% for dairy, beef and sheep

Launching in coming years globally
Lifetime performance & welfare

Only healthy, productive animals lead to healthy business

We have developed full nutritional programs to address the species specific needs of sustainable production.
We have cost effective, proven solutions

Through a scientifically grounded and proven nutritional lifetime performance program from calf to cow. It is designed to improve dairy productivity, profitability & sustainability.

McGrath et al., 2017: Research in Veterinary Science (2017)
Our approach to sustainable dairy production is non-medicated and preventive through nutritional means

1. **Optimum blood calcium levels:**
   - 25-OH D3 for skeletal development & health

2. **Nutrient utilization:**
   - Phytogenics x Biotin x amylase for high milk efficiency, and acidosis prevention

3. **Fertility:**
   - B-Carotene (fertility vitamin)

4. **Ketosis, mastitis, lameness:**
   - Vitamin E, Biotin, Phytogenics

5. **Greenhouse gas emissions:**
   - 3-NOP for direct emissions & all the above for indirect emissions
IMPROVING DAIRY COW LIFETIME PERFORMANCE...

...IS THE KEY ENABLER FOR SUSTAINABLE DAIRY FARMING