Sustainability in Animal Nutrition & Health

DSM Hungary

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Driving profitable growth through science-based, sustainable solutions

We develop sustainable science-based nutritional solutions for producers worldwide that enable the sustainable production of dairy, meat, eggs and fish protein for a growing population.
Demand for animal protein is increasing

- Driven by population growth, rising incomes & balanced nutrition
- Aquaculture will grow +34% by 2026
- Poultry meat will grow +16% by 2026
- 63% of the growth in meat consumption will come from aquaculture & poultry by 2026
- To grow more we need to stay within planetary boundaries

Source: OECD-FAO 2017
Increasing attention on balanced nutrition

Drive for balanced nutrition will result in decreasing meat consumption in OECD countries & an increase in developing countries.

- UK government recommends 70g/day (25.55kg per capita/yr)
- Chinese health ministry recommends 40-75g/day (14-27kg per capita/yr)
- Balanced nutrition will contribute to staying within planetary boundaries

Annual per capita consumption (kg)

<table>
<thead>
<tr>
<th>Country</th>
<th>Consumption (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>120.0</td>
</tr>
<tr>
<td>Germany</td>
<td>88.0</td>
</tr>
<tr>
<td>Brazil</td>
<td>85.3</td>
</tr>
<tr>
<td>China</td>
<td>58.2</td>
</tr>
<tr>
<td>Kenya</td>
<td>16.7</td>
</tr>
<tr>
<td>Indonesia</td>
<td>11.6</td>
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</tbody>
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Source: FAO, 2009
Livestock sector has a footprint...

- Global agricultural land devoted to livestock feed & pasture: 50%
- Water used in total food production: 50%
- Global GHG emissions: 14.5%
- Human caused biodiversity loss: 30%

Source: FAO; Mottet at al., 2017
... giving rise to a multitude of challenges
Livestock eat 6bn tons of dry matter of which 86% is not eaten by humans

- 6bn tons of DM = 60% of the world’s total feed & food combined biomass
- 30% of livestock-consumed DM is derived from residues & by-products from the agri-food chain
- By-product consumption is expected to grow as the population increases & more processing takes place

Source: Mottet et al, Global Food Security 14 (2017) 1.8
Livestock substantially contributes to protein supply without triggering food/feed competition

- Production of global feed requires 2.5bn ha of land (50% of global agri area)
- 2.0bn ha of this is grassland
- Of which 1.3bn ha cannot be converted to crop land
- Which means 57% of land used for feed is not suitable for direct food production

Source: Mottet at al, Global Food Security 14 (2017) 1.8
Animal production contribution...

- Uses marginal lands
- Turns by-products into edible proteins and goods which would otherwise be an environmental burden
- Contributes to crop productivity (manure: 38% of N inputs in Europe)
- Turning edible crops into highly nutritious protein rich food
Nevertheless non-ruminants use more human-edible feed per unit produced

<table>
<thead>
<tr>
<th></th>
<th>Ruminant</th>
<th>Monogastric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1kg boneless meat</td>
<td>2.8kg</td>
<td>3.2kg</td>
</tr>
</tbody>
</table>

- Ruminant: typical low efficiency extensive system, but very efficient when expressed in terms of human-edible feed use
- Non-ruminants: consume less, but higher energy feed of which a higher proportion is human-edible feed
- Expected rise in by-products production & their use in monogastric nutrition along with FCR improvements will reduce this number

FCR must improve otherwise more land is needed to produce enough animal protein for a rising population

- Main factors affecting FCR
  - Feed quality
  - Genetics
  - Health
- Gains are expected in advanced systems through precision farming & development of feed additives

Source: Mottet at al, Global Food Security 14 (2017) 1.8
Animal protein production makes large demands on available raw materials

- Limitations in ingredients such as:
  - Digestible protein
  - Digestible energy
  - Phosphates
  - Omega-3 fatty acids

- Feed additive technologies are essential to extracting more out of less, closing gaps on raw material scarcities and allowing animal production to operate within planetary boundaries
Broiler production meeting the global protein challenge

• Protein is one of the most expensive raw materials in a broiler diet, but essential for growth

• Must use protein sources as efficiently as possible through;
  • Phase feeding
  • Ideal protein ratios
  • Low protein diets
  • Synthetic amino acids
  • Protease enzymes
Ronozyme® ProAct reduces protein use & nitrogen flow to the environment

Enzymes are a critical tool for maximizing protein and amino acid digestibility and improving FCR.
**Ronozyme® NSP enzymes play a key role in releasing trapped dietary energy**

- Plant cells are a rich source of energy in the form of carbohydrate
- But NSP are not digested by intestinal enzymes
- Grinding, conditioning, pelleting, and chewing or gizzard action partially ruptures tough plant cell walls, but the accessibility of the cellular constituents remains limited
- NSP enzymes significantly improve carbohydrase digestibility & FCR
Alleviating pressure on finite rock phosphate resources through use of Ronozyme HiPhos

What would happen if we replaced Mono Calcium Phosphate (MCP) with Ronozyme® HiPhos in the 200 million tons of pig feed consumed each year?

- It would decrease CO₂ emissions by 1.3 million tons per year that's like taking approximately 500,000 cars off the road.
- It would reduce consumption of scarce rock phosphate resources.
- It would reduce algae bloom by reducing phosphorus emissions from manure into lakes and rivers.
- It would reduce energy consumption in production.
Marine resources and biodiversity are under severe pressure

- Anchovy
- Menhaden
- Sprat
- Blue Whiting
- Herring
- Sand eel

16,000,000 tons wild fish

~17% of global wild catch is consumed for the production of fish oil and fishmeal

The limit for fish meal and oil has been exceeded & future growth of aquaculture needs alternative sources of omega-3 (EPA+DHA) oils

Sources: IFFO, FAO
Addressing the omega-3 (EPA+DHA) resource gap through sustainable algal solutions

DSM and Evonik breakthrough – shortening the natural food chain
Precision nutritional programs will help improve herd performance

• Improving herd productivity is a key objective for agriculture to meet consumer demand & yet stay within planetary boundaries
• Reducing replacement rates
• Improving reproduction rates
• Increasing the number of parities
• Micro-nutrition and the use of feed additives play an essential role in increasing herd productivity
Improving life-time performance through micro-nutrition transforms herd sustainability

Improved longevity leads to more milk production and lower herd replacement rates
Poor frame development of gilts & leg disorders of sows has led to reduced herd performance & replacement.

Improving skeletal development, gilt selection and sow productivity through advances in vitamin nutrition (OVN) leads to greater productivity, improved welfare and a more sustainable herd performance.
GHG emissions are on the rise with livestock & methane as important contributors

• Livestock is responsible for 14.5% of total human induced GHG emissions
• Methane is the main GHG emission
• While CO$_2$ persists in the atmosphere for centuries, methane warms the planet very fast for a decade or two before decaying to CO$_2$
• The impact of methane is 84 times that of CO$_2$ (IPCC data)
• This presents a major challenge for animal production
Livestock is a significant source of GHG emissions, with the majority coming from methane.
Methane emissions from agriculture are increasingly in the spotlight.
Methane inhibition can be achieved through advanced, precision feed additive technology.

- New feed additive technologies are tackling difficult sustainability challenges such as methane emissions.
- Allowing agriculture to grow within planetary boundaries.
AMR has accelerated due to the overuse and misuse of antibiotics, and pollution from irresponsible production.
A holistic approach to health management including feed additive functionality

- Operating in an antibiotic-free system will require a holistic approach to gut health
- Upgrading of management practices
- Renewed focus on nutritional solutions
- Greater use of eubiotic ingredients
- This presents a major challenge & opportunity for animal production, but with growing concern throughout the value chain it must be tackled fast
DSM’s strategy is well aligned with UN Sustainability Development Goals

1. NO POVERTY
2. NO HUNGER
3. GOOD HEALTH
4. QUALITY EDUCATION
5. GENDER EQUALITY
6. CLEAN WATER AND SANITATION
7. RENEWABLE ENERGY
8. GOOD JOBS AND ECONOMIC GROWTH
9. INNOVATION AND INFRASTRUCTURE
10. REDUCED INEQUALITIES
11. SUSTAINABLE CITIES AND COMMUNITIES
12. RESPONSIBLE CONSUMPTION
13. CLIMATE ACTION
14. LIFE BELOW WATER
15. LIFE ON LAND
16. PEACE AND JUSTICE
17. PARTNERSHIPS FOR THE GOALS

FOR INTERNAL USE ONLY
So what can you do?

Keep providing a nutritious diet to the world population. Produce food using the proper feed additives:

- It generates **Profit** for you
- It has a low impact on the ecology of the **Planet**
- It will have a positive impact in the wellbeing of **People**