Reducing methane and other greenhouse gas emissions from dairy farming
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The population in the world is steadily increasing and is predicted to exceed nine billion people by 2050. The current trend of urbanisation is set to intensify as more and more people move from the country side to cities in search for jobs and a more modern lifestyle. As economies grow and family incomes increase consumption patterns are also changing. With different eating habits the demand for beef and dairy products as well as processed food is rising.

To meet this demand the agricultural sector needs to produce more safe and nutritious food. At the same time, it must secure that the conditions of the natural resources can continue to support an increased food production. In order to do so, farmers need to contribute to the reduction of the emissions of greenhouse gases in order to protect/safeguard the life supporting ecosystems of our planet. The reduction of emissions of greenhouse gases and the management of the effects caused by global warming will be among the biggest environmental challenges in the next hundred years.

As a supplier of milking equipment, we support dairy farmers with efficient equipment, consumables and services for their dairy production. We do so while working towards realising our company vision; to make sustainable food production possible. In other words, we aim to support our customers in reducing the environmental impact of their farms through improving milk production, farm profitability and the well-being of the people and animals involved.

This paper presents how DeLaval supports dairy farmers to reduce the amount of greenhouse gases emitted per kilo of milk. Methane gas is the main contributor to global warming when it comes to dairy farming.
Which greenhouse gases do dairy farms emit?

The emissions of greenhouse gases from a dairy farm are made up mainly of, methane (CH4), nitrous oxide (N2O) and carbon dioxide (CO2). In general, the split is 50%, 30% and 20%, respectively.

In this graph you can see how the different sources of the three gases are identified and quantified:

Methane gas is predominantly produced in ruminant animals' stomachs (the enteron) and 95% of it released via the mouth while the animal is ruminating.

This image shows how methane (CH4) is emitted by ruminants:

Regional differences of actual emission levels per kilo of milk produced vary widely. The differences are explained by the respective shares of different types of animals in total, livestock production and by differences in emission intensities for each product and between regions.

Feed-related emissions, including emissions from pasture management, represent the second largest category of emissions, contributing to around 36% to milk and beef emissions. When emissions from pasture expansion are added, feed emissions represent more than half of the emissions in specialised beef systems. Dairy systems are generally not associated with deforestation and pasture expansion.

Carbon dioxide emissions from energy use in feed supply chains represent about 10% of overall emissions. Emissions from energy consumption on farms and in processing are negligible in beef and limited in dairy (around 8% of emissions).
DeLaval can support farmers to reduce greenhouse gas emissions

There are a number of different options for dairy farmers to reduce the amount of greenhouse gas emissions per kilo of milk produced.

• Methane emissions are mainly related to rumination and the focus should be on improving the productivity of the cows over their lifetime.[2] This includes securing that the conditions under which calves and heifers are kept to allow them to stay healthy and grow quickly. After the young heifer turns into a cow, proper feeding and milking become ever more important in supporting a healthy and productive life.

• The nitrogen gas emissions can be reduced if the feed production is optimized and synthetic and manure based fertilizers are carefully applied and applied at the correct time.

• Increasing the energy efficiency of farm equipment using diesel and other fossil fuels drives down carbon dioxide emissions.[3]

DeLaval supports farmers by offering services and products designed to improve productivity and the welfare of animals. We believe that by focusing on cow well-being and comfort, improved herd management, and better handling of feed and manure, a more sustainable milk production can be achieved.

Examples of ways DeLaval can help to increase productivity are listed below. Their effect on productivity depends on the current levels and the total effectiveness of the management of the farm.

Cow well-being and comfort

Cow well-being and comfort result in healthier cows producing more milk. They also contribute to better working conditions for people working on the farm. Good comfort means allowing a cow to lie down and walk without stress or injuries. This allows her to ruminate in a way that her milk yield is optimised and her to feed and be milked without experiencing hoof pain. Both help secure higher yields. In addition, proper ventilation, temperature control, and general illumination all contribute to keeping the animals productive as they are less stressed. In many ways, the same factors that make a cow comfortable also make the working conditions in a barn better for humans. More important is that healthy, stress-free cows are easier to manage and require less special attention.

DeLaval supplies a wide range of proven solutions, equipment, consumables and accessories to help farmers to optimally control the production of highest quality milk from healthy cows.

For more details see e.g.:
FAO, 2013, MITIGATION OF GREENHOUSE GAS EMISSIONS IN LIVESTOCK PRODUCTION
Herd management

DeLaval offers a wide range of solutions that supports the monitoring and management of the herds. In order to reduce environmental impact and resources used per kilo of milk produced it is critical to reduce the non-productive periods of an animal’s life when not producing milk and to optimise yield.

DeLaval Herd Navigator™ is an animal health tool that analyses milk to detect mastitis, ketosis, heat, reproduction and/or metabolic disorders. This groundbreaking system makes it easier to manage reproduction, feeding management, and udder health. The focus of DeLaval Herd Navigator™ is to secure that animals in heat are detected early, that calving interval and involuntary culling are reduced, and that periods with health problems - when milk needs to be discarded or lead to involuntary culling - are minimised. This actively contributes to reducing the environmental impact per kilo of milk produced by the herd. Such early detection also allows for reduced antibiotics use, which means that fewer antibiotics are discarded into waste water and manure going out from the barns.

Feed management

Cow well-being and comfort result in healthier cows producing more milk. They also contribute to better working. Optimised feed management reduces the environmental impact of an animal. This is done by firstly securing that the animal grows from a healthy calf to a heifer that can be inseminated early. The likelihood of getting the animal pregnant and being healthy throughout her lactations also improves if she is fed correctly. These effects result in less non-productive time being spent on growth or dry periods. The better the animal’s energy needs are met, and the less time the animal is sick while producing milk, the more milk she will yield, both during lactations and over her total lifetime. As methane gas is always produced, the shorter the non-productive periods can be the less environmental impact will be produced per kilo of milk.

Feed quality can be improved by using the correct feed additives. DeLaval provides additive options for high-quality silage. We also provide systems and products to improve feeding efficiency and animal performance, regardless of existing feeding strategy or farm layout.

DeLaval also engages in scientific, technical, and commercial development related to the dairy value chain and in particular milk production. We both share our knowhow and stay informed via collaborations with industrial networks such as International Dairy Federation, Dairy Management Institute (in the US), SAI platform as well as scientific conferences such as the Greenhouse Gases & Animal Agriculture Conference. We are also associated with the scientific network on ‘Feed and Nutrition in Relation to Greenhouse Gas Emissions’. Through these contacts with researchers, we keep abreast of scientific development related to different mitigation options.

Moving forward, there are a number large opportunities for farmers that have yet to adapt best practices and using best-available technologies. DeLaval sees the potential to go beyond the current performance levels of many systems and individual solutions that can improve productivity and reduce methane gas emissions. Our role as a supplier will be even greater as we add more automation, data collecting sensors, and management tools to our portfolio. These could include the monitoring and analysis of feed, animals and the equipment.
Background

What is global warming?

Our planet is surrounded by a layer of gases that lets most sunlight through. When the high energy sunlight hits the Earth's surface it is reflected as light but most of it is transformed into heat. When these two kinds of radiation reach the atmosphere, heat radiation will not pierce the gas layer as easily as light rays. They are instead reflected back into the atmosphere and contribute to keeping the average surface temperature higher than it otherwise would be. This effect is similar to that in a greenhouse, where the glass ceiling lets the light through but keeps the heat rays in. The gases in the gas layer are therefore called “greenhouse gases”.

The primary greenhouse gases are water vapour, carbon dioxide, methane, nitrous oxide and ozone. Without them, the Earth's surface would be about 33°C colder, well below the present the average global surface temperature of 14°C (57°F). The average temperature greatly influences the climate on Earth. It has stayed around 14°C for about 10,000 years and the climate has been stable over this time. It is important to distinguish between weather and climate; climate is the average weather over longer time periods and larger areas. Weather is the local conditions at a certain time. However, since the beginning of the industrial revolution of 1760, mankind has increased natural atmospheric concentration of greenhouse gases by 40%.

The emission of greenhouse gases continues to increase and has risen by 45% since 1970. The concentration of carbon dioxide in the atmosphere has increased to 392.6 parts per million (ppm) in 2012 from a pre-industrial level of about 280 ppm.

Based on the ongoing increase of greenhouse gases in the atmosphere, a large majority of the scientific community predicts that the average global surface temperature will increase and affect most ecosystems on Earth and the livelihoods of over three billion people worldwide. The Intergovernmental Panel on Climate Change (IPCC) stated in the spring of 2014 that, “Without additional efforts to reduce greenhouse gas emissions beyond those in place today, emissions growth is expected to persist driven by growth in global population and economic activities. Baseline scenarios, those without additional mitigation, result in global mean surface temperature increases in 2100 from 3.7 to 4.8°C compared to pre-industrial levels.”

Limiting global warming will require substantial and sustained reductions of greenhouse gas emissions. It may also require that the concentration of carbon dioxide in the atmosphere is reduced by removal, such as the sequestering of carbon by growing more trees that absorb carbon dioxide.

Global warming is an important challenge for the agricultural sector

The population in the world is steadily increasing and is predicted to reach nine billion people by 2050. The demand for food is expected to increase by 70% according the Food and Agriculture Organisation of the United Nations (FAO). Continued improvement in the quantities and the quality of agricultural output is critically important for feeding the growing global population sufficiently with both calories and nutrients. This is the only way to secure healthy lives and to provide incomes and economic security to the close to one billion people that depend on farming for a living.

Agriculture is highly exposed to climate change as farming activities directly depend on climatic conditions such as temperature, humidity, cloudiness, and precipitation. Simultaneously, agriculture is one of the sectors of the economy that directly contributes the most to the increasing manmade emissions of greenhouse gases, see graph below.

This puts great pressure on the agricultural sector to secure sufficient supplies of safe and high quality food by developing productive and resource efficient production systems. The agricultural sector faces great challenges to increase its production while reducing its environmental footprint not just its direct and indirect emissions of greenhouse gases. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.
Improving productivity and profitability are key strategies towards a more environmentally sustainable food production that also supports economic development and social stability. There are large differences between different farms and regions as well as the rapid pace of change, including the application of breeding, technologies and management practices equals large opportunities for productivity improvements.

According to the Intergovernmental Panel on Climate Change, agriculture, forestry and other land use (AFOLU) accounts for about 25% of the manmade emissions that increase the concentration of greenhouse gases in the atmosphere. The emissions come mainly from deforestation, agricultural emissions from soil, and nutrient management and livestock. The animals represent approximately 13% of the total global emissions. The remaining 12% comes from forestry and other land uses.

The link between climate change and livestock-based agriculture

Greenhouse gases produced by livestock dominate the emissions from the AFOLU sector. This fact has been highlighted in the public debate ever since the FAO report “Livestock’s Long Shadow” was published in 2006. In the more recent FAO report “Tackling Climate Change Through Livestock” published in 2013, the total volume of greenhouse gases produced by livestock was estimated to be 14.5% of all human-induced greenhouse gas emissions. This figure should be seen as an estimate, as it depends on fair share of assumptions and a very large number of uncertain data points.

Livestock consist of several different kinds of animals, all with different levels of impact. The FAO report estimates that out of the 14.5% of total emissions, the share from beef animals is 35% and dairy cattle contribute 30%, while pigs, buffaloes and chickens contribute the equivalent of about 9% each. The rest come from small ruminants and other species of poultry. See figure 2 below, taken from FAO’s report Tackling climate change through livestock.

![Figure 2. Global estimates of emissions by species](image)

*Includes emissions attributed to edible products and to other goods and services, such as draught power and wool.
1 Producing meat and non-edible outputs.
2 Producing milk and meat as well as non-edible outputs.
Source: GLEAM.