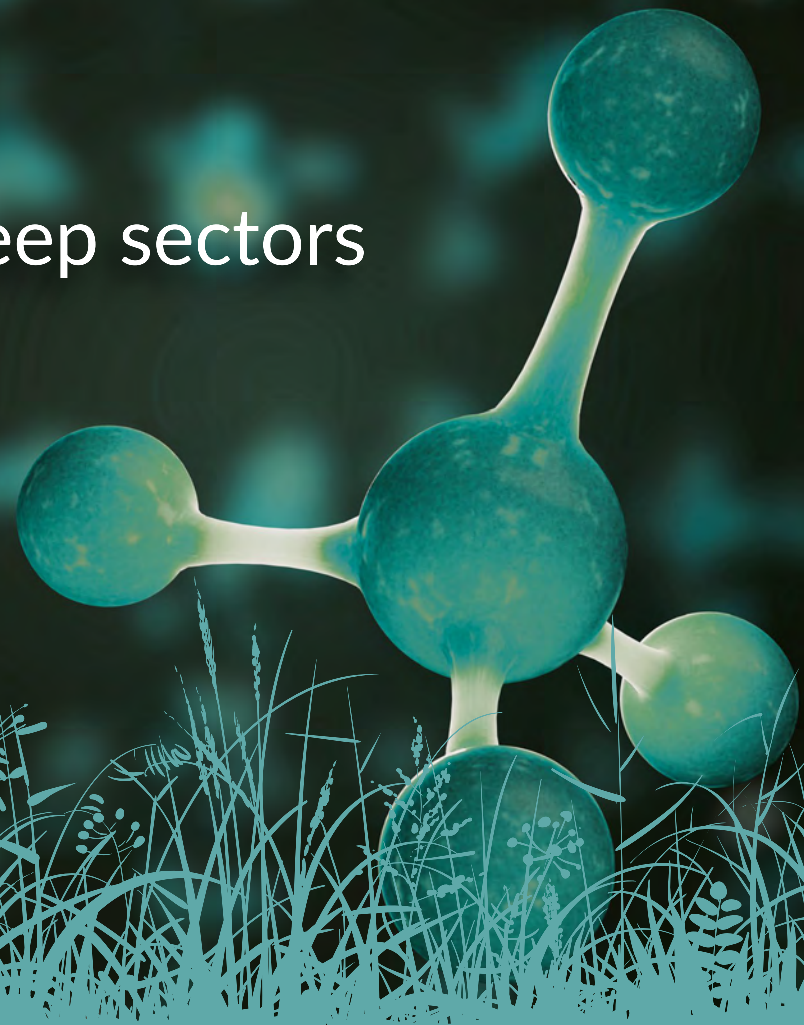
Acting on methane:

opportunities for the UK cattle and sheep sectors



A report prepared by Moredun Research Institute on behalf of Ruminant Health & Welfare

Summary

- The UK Government signed a global pledge at COP26 to reduce methane emissions by 30% by 2030
- Methane is a potent greenhouse gas, with approximately 80x more global warming potential than CO2 over its short 10–12-year lifetime
- Atmospheric methane from UK ruminants is roughly static (breaking down at the same rate as being emitted); however, ruminants are still responsible for around 45% of UK methane emissions
- Poor animal health is a major constraint on efficient livestock production, and therefore a source of excess methane emission here in the UK, and across the world
- High herd and flock health status provides economic and welfare benefits, but also supports new methane emissions mitigation measures such as breeding, nutrition, and the use of feed additives
- Improving animal health and reducing associated methane emissions is something we can do now, with the knowledge and tools we already have available

Introduction

Background

One of the major deals which came out of the COP26 conference in Glasgow was the Global Methane Pledge (GMP), which commits 100 countries to reducing global methane emissions by at least 30% by 2030. It is estimated this could reduce projected global warming by 0.2 degrees by 2050[1] – a tiny reduction, it would appear, but every fraction of a degree is vital. The good news is that the UK ruminant sector can contribute to this goal simply by improving the health of our flocks and herds. This will also underpin other interventions such as breeding and nutrition, and will have positive welfare and economic spin-offs too.

In this briefing, produced by the Moredun Research Institute for Ruminant Health & Welfare (RH&W), the key health and welfare-related causes of additional methane emissions are identified. These are then mapped against diseases identified in RH&W's 2021 'grassroots survey' of priority conditions[2], alongside available interventions, to provide a starting point for discussions between farmer and vet or animal health adviser about health planning, with methane in mind. However, implementing change on the back of this briefing offers opportunities to not just trim back methane emissions, but also to reduce losses and increase productivity.

Why methane?

Methane is an important greenhouse gas (GHG), with a global warming potential (GWP) 28 times greater than CO_2 over 100 years, but approximately 80 times more warming than CO_2 over its first decade. Because methane is a powerful GHG over its short lifetime in the atmosphere, we have an opportunity to reduce emissions and associated warming in the short-medium term, while we work away at reducing the other important and more intractable GHGs like CO_2 and N_2O. Some 45% of UK methane emissions come from ruminants[3], the majority being enteric emissions associated with the natural digestion of cellulose in the rumen, with the remainder linked to manure, slurry and their management.

Who needs to act?

We know that methane emissions from UK ruminants are currently relatively stable, breaking down at the same rate they are emitted[4, 5]. However, the focus on ruminants is not about who caused warming historically or who is contributing to it now – it's about what we have in our toolbox to cap temperature rise before it reaches a tipping point. UK ruminant agriculture has an opportunity to be at the forefront in helping to be part of the solution. But to contribute to a solution, methane emissions from ruminant livestock need to fall.

The role of ruminant health and welfare

Livestock health is a major constraint on efficient livestock production, both here in the UK and across the world. Recent reports[6, 7, 8, 9] suggest as much as a 10% reduction in GHGs from livestock is feasible through improved health status alone (with additional reductions possible from breeding and feeding), and that sheep and cattle health are both viable policy options for mitigating agricultural GHG emissions[10].

The recent RH&W 'grassroots survey'[2] primarily looked at production efficiency and welfare, and was based on the ADAS and ClimateXChange lists of 'climate diseases'[6, 7]. The consensus from expert groups meeting since is that most, if not all, of the health conditions that impact on production, welfare and/or economics, align with conditions that have the biggest impact on the carbon footprint of livestock production.

Improving the health status of our flocks and herds is a priority intervention – not just in reducing the carbon cost of production, but in also creating a stable health platform to underpin future methane-reducing interventions including breeding and feeding.

Which RH&W target health conditions have the most impact on methane emissions?

Table 1: Outlines the three main strategies for reducing methane emissions, and the reasons why[11]

Strategy	Reason
• **Higher growth rate/daily liveweight gain**	Reduces days to slaughter or days to first parturition
• **Better feed conversion efficiency (FCE)**	Reduces levels of inputs, increases growth rate (see above) and improves reproductive performance
• **Less involuntary culling/abortion in breeding stock**	Reduces replacement rates, increases reproductive performance, reduces numbers of followers and protects selected (GHG-lowering) genetics in the future

Typically, the most efficient animals in a flock or herd grow the fastest, convert their feed the best, require fewer inputs and have a lower environmental footprint as a result. Optimising growth rates through good health and welfare, and nutrition, will boost the efficiency of all our livestock farming systems. Greater longevity of breeding stock can reduce the need to rear replacement stock, although this should be balanced against the potential for genetic improvement.

What can we do about this now?

The health conditions (diseases and syndromes) considered to negatively impact methane emissions from ruminants are identified in Tables 2, 3 and 4. Bovine tuberculosis (bTB) has been included because it, too, impacts methane emissions, although government control and statutory testing mean it is not a disease Ruminant Health & Welfare is involved with directly.

We encourage livestock farmers to engage with their vets and animal health advisers to identify the major issues on their own farms, as every farm will be different! This can be done as part of ongoing regional or national disease control schemes, and proactive, regularly reviewed livestock health plans.

Measuring progress

Monitoring and diagnosis are key to managing endemic disease threats. As Table 2 indicates, there are good diagnostic tests available for most of the major endemic diseases that livestock are likely to encounter in the UK. We would encourage farmers to make the best use of all available tests and biosecurity measures – this will be money well spent. Veterinary advice is invaluable, especially as part of a flock or herd health plan which seeks to systematically tackle the greatest challenges.

Also, use vaccines where possible and appropriate to protect animals from (re)infection and reduce the need for chemical treatments further down the line.

Future interventions

Improving health and welfare could reduce emissions by 10%. However, improved performance in this area also lays down the groundwork for other interventions – precision nutrition, the inclusion of oils and the wider adoption of conventional breeding goals, which are based on balanced breeding goals, are all interventions that are immediately available. In the near future, feed additives[12] and new genetics in cattle[13], namely feeding and breeding for reduced emissions, are both likely to be important methane management tools. Work on the genetics of the rumen flora may also be of significant value. In any event, these existing and novel interventions require herds and flocks to be in good health for optimal expression, so high health status should be a win-win. That said, any novel interventions must be validated, quantified, and be confirmed as factors that will be incorporated into the national GHG inventory before they will become viable mitigation measures.

Table 2: Health conditions considered to negatively impact methane emissions from ruminants, how they impact, and how they can be diagnosed and controlled

		KEY DISEASES – CATTLE						KEY DISEASES – SHEEP				KEY DISEASES – PARASITIC		
		Bovine Tuberculosis (bTB)	Bovine Viral Diarrhoea (BVD)	Johne's disease (MAP)	Bovine Respiratory Disease (BRD)	Infectious Bovine Rhinotracheitis (IBR)	Dairy Cow lameness	Sheep Scab	Jaagsiekte OPA	Iceberg diseases (BD, MV CLA, Johne's)	Lameness /CODD	Gut worms PGE (Parasitic gastroenteritis)	Liver fluke	Coccidia (Lamb/Calf)
Methane impact	Growth rate		✓		✓	✓		✓			✓	✓	✓	✓
	Feed conversion efficiency (FCE)			✓			✓	✓		✓	✓	✓	✓	
	Involuntary culling or abortion	✓	✓	✓		✓	✓		✓	✓	✓			
Prevalence	Significant at a national level			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Significant at a regional level	✓						✓				✓	✓	
	Prevalence reports increasing						✓		✓	✓	✓		✓	
Diagnostics & Screening Programs	Laboratory diagnostics robust	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓
	Sensitivity may be compromised	✓		✓		✓								
	Post mortem or scanning	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Health scheme screening standards		✓	✓		✓				✓				
Treatment & prevention	Effective therapy available				✓	✓	✓	✓			✓	✓	✓	✓
	Treatment compromised by resistance							✓				✓	✓	
	Biosecurity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Vaccine available		✓	*	✓	✓					**			
Recognition of disease	RHW top 10 priority		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	RHW welfare top 10 priority		✓	✓	✓		✓	✓			✓	✓	✓	
	GHG designated (ADAS, ScotGov)		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
	Trade EU AH law	✓	✓	✓		✓								

* The Johne's disease vaccine which is available reduces the clinical impact in clinically affected herds but does not stop the spread of infection as faecal shedding is not controlled. The use of the vaccine blocks the use of serological testing to manage the disease. These two factors mean that a vaccine approach is not advised here.
** Although a vaccine is available for footrot, there is currently no CODD vaccine available.

Targeting health conditions

There are two ways of viewing livestock health conditions, either as single agent infectious diseases, or as multi-factorial 'syndromes', both have equal merit. The latter may have a disease component, for example, Neospora is a cause of reproductive failure in cattle, BVD and IBR can be implicated in Bovine Respiratory Disease and Johne's Disease is a cause of involuntary culling. However, syndromes can also have a metabolic, nutritional, genetic, environmental and managemental basis and are multi-factorial in nature.

The diseases considered to negatively impact methane emissions from ruminants are identified in Table 2 which has been designed to showcase how they impact methane emissions, how they can be diagnosed and controlled and why they are identified as a priority health condition for the industry.

Other potential health conditions in cattle and sheep that are likely to impact methane emissions are also identified in Table 3. Then syndromes that are likely to impact methane emissions, with a focus on dairy cattle, are detailed in Table 4.

These tables can all be used to help consider health conditions that you can potentially identify on-farm to continue to or start to track performance indicators to spot where negative impacts on methane emission can be reduced.

Performance Indicators

RH&W, as part of its 2021 'Grassroots' Survey, sought the views of the farming community and animal health professionals on a range of animal health conditions and their impact on both production efficiency and animal welfare.

The value of using a syndromic approach, related to key stages of production, was to provide a gateway to animal health planning, which had the potential to directly improve performance. A syndromic approach also opened up a whole system review including environment, nutrition and genetics in addition to health, representing a tailored solution which can underpin significant and sustainable change.
Defra has published baseline national herd performance data for the dairy sector, which quantifies physical performance that impacts on GHG emissions. The Defra paper[18] focuses on longevity and fertility, which both fit with disease features linked to the carbon intensity of production and to total emission levels.
Quality Meat Scotland references key syndromic performance indicators[19], such as calves reared as a percentage of cows served, that clearly impact on herd cull and replacement rates which is a key goal and also directly reduces the carbon intensity of production. Similar data is also published for a range of sheep systems.

Table 3: Examples of other potential health conditions likely to impact methane emissions

		CATTLE	SHEEP
Methane Impact	Growth rate	Mycoplasma; Lungworm; Cryptosporidium	Fly strike; Pine; Orf
	Feed conversion efficiency (FCE)	Lungworm	Cobalt / Selenium / Copper deficiency
	Involuntary culling	Mastitis; Infertility	Mastitis; Infertility

Table 4: Syndromes considered to negatively impact methane emissions in cattle, with a focus on dairy

SYNDROME	RHW Priority Rank Order: Production efficiency	Impact on total emissions			Impact on carbon intensity of production
		Feed conversion efficiency (FCE)	Growth rate or milk production [p]	Involuntarily culling of breeding stock, inc. abortion	
Reproductive failure	2			✓	✓
Neonatal disease (inc. young calf disease)	4	✓	✓		✓
Bovine Respiratory Disease (BRD)	3	✓	✓		✓
Mastitis: acute	8	✓	✓	✓	✓
Mastitis: sub-clinical	5	✓	✓	✓	✓
Metabolic disorders	6	✓	✓	✓	✓
Lameness	1	✓	✓	✓	✓
Involuntarily culling	7	✓	✓	✓	✓

Illustrating the impact

Sustainable parasite control

Recent studies indicate that gastrointestinal parasitism leads to a minimum 10% increase in GHG emissions in lamb production[14, 15], and liver fluke infection adds an extra 19 days to slaughter in cattle, reducing growth rate by 4% and adding 2% to the GHG footprint[16]. In both of these scenarios, approximately half of the GHG emissions will be methane. Routinely monitoring worms and fluke can help enormously when deciding if/when to treat, what product to use, and whether treatment has worked or not. This also has the spin-off benefit of avoiding unnecessary anthelmintic treatment (expense and labour) and slowing down selection for resistance.

Losses from Johne's Disease

The classical signs of clinical Johne's Disease (caused by infection with MAP bacteria) are profuse scour and condition loss, which can have a catastrophic impact on health, welfare and production. Infection reduces nutrient absorption and utilisation which depresses milk yield and reduces fertility, pulling down herd performance and increasing replacement rates. Clinical cases often indicate sub-clinical disease in a wider group of animals, where disease impact may be unseen but production losses will also be significant. Johne's Disease has been estimated to increase GHG emissions, of which at least half will be methane, by approximately 25% per litre of milk and 40% per kg of beef[6]. The increased involuntarily culling in herds affected by Johne's Disease also raises replacement rates and total GHG emission levels.

Aligning objectives

As a last word, farmers will want to improve the overall efficiency of production, and reducing the burden of endemic disease will certainly contribute to that. Governments, on the other hand, are bound by international climate change agreements which focus on the reduction of total GHG emissions. That obligation is quantified in national inventories, which capture the emissions created by national production; the carbon cost of imported product impacts on the inventory of the exporting state. It is important, therefore, that total ruminant headcount does not increase as a by-product of interventions that, for example, increase reproductive rate or reduce mortality, as this will immediately increase total national methane emissions.

Unless we as an industry take control, the easy option is to down-size the ruminant sector. Indeed, that vision is already embedded in UK Government thinking (UKCCC Report 2020, p9, 10% reduction in cattle & sheep numbers by 2050[17]).

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The author would like to acknowledge expert help and input from Dr Vera Eory and Dr Michael MacLeod (SRUC); Dr Tom McNeilly and Dr Craig Watkins (Moredun Research Institute).

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This report is based on work undertaken by the Ruminant Health & Welfare Group, but also the Livestock Health Scotland and SEFARI Livestock Health & Greenhouse Gas Special Advisory Group, funded by the Scottish Government

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