NET ZERO & LIVESTOCK

How farmers can reduce emissions: **BEEF**

CIEL

Current sector snapshot

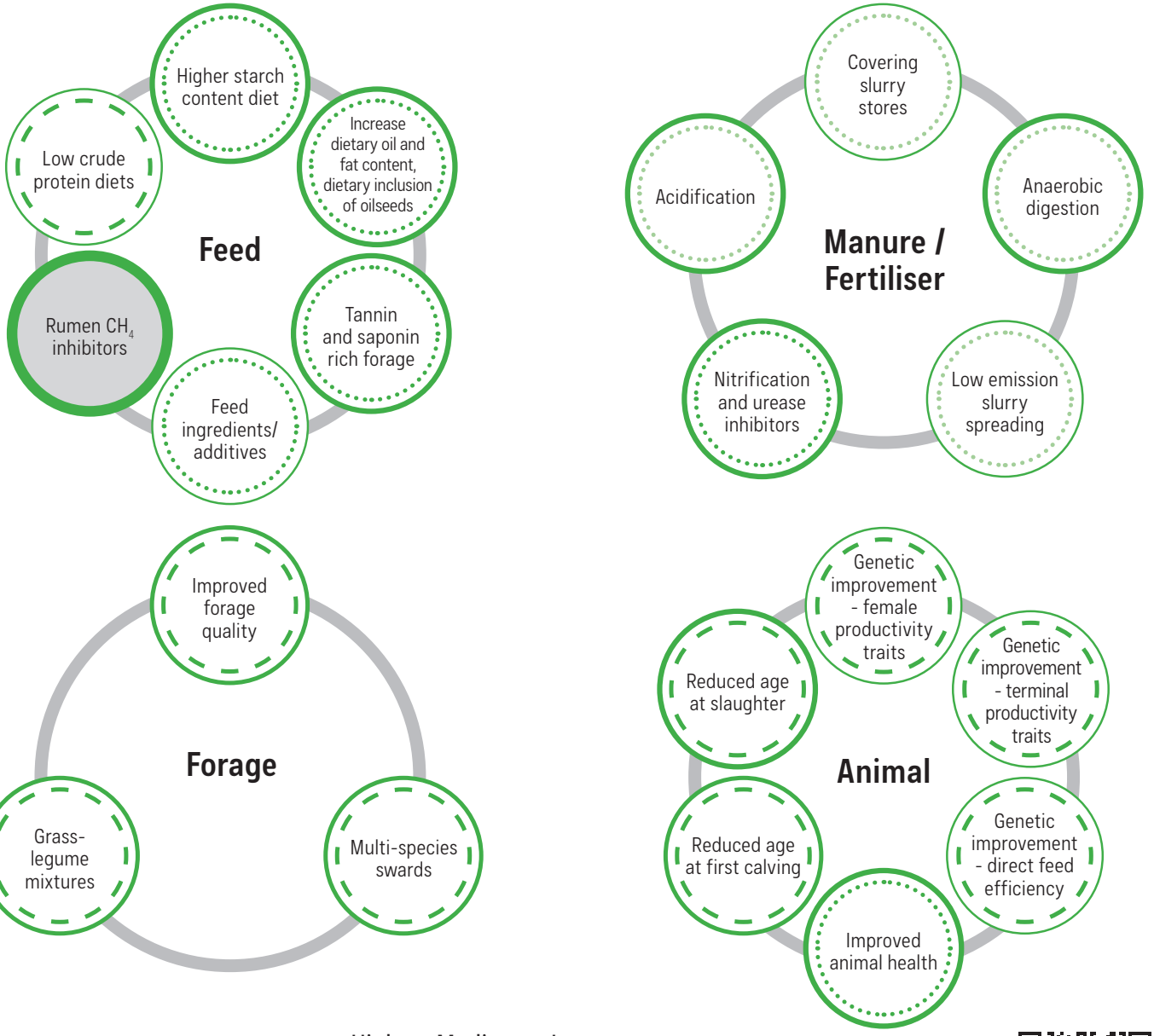
£ £2.9bn – Value of UK Beef and Veal production (2020)
11% of gross UK agricultural output

CH_4 (from digestion of feed and slurry storage); and N_2O (from fertiliser & slurry application) = Largest components of on-farm emissions from UK beef production

Gradual improvements in feed efficiency achieved through breeding programmes and nutritional management

GHG emission intensity of UK produced beef ≈ 48kg CO_2 - eq/kg of meat from dedicated beef herds, equivalent to half of global average (99kg CO_2 - eq/kg)

Potential for mitigating GHG emissions in Beef



Key	High	Medium	Low
Impact on Carbon Footprint	●	○	○
Cost	◌	◌	◌
Mitigation not yet widely available	●		

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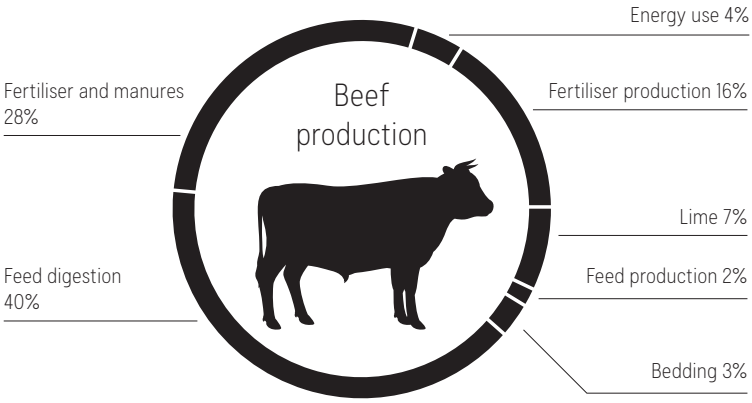
Putting it to the test: Beef Cattle

Using real farms to calculate emissions generated by specific scenarios that are indicative of the potential savings available in the sector.

Farm facts:

- 100 cow herd
- Cows average 700kg liveweight (LW)
- Silage-based winter diet
- Calving rate 86%
- 79 animals slaughtered per year
- All pasture >10 years old
- Rearing rate 80%
- Beef animals slaughtered at 21 months old, weighing 650kg liveweight, 364kg deadweight
- Homebred heifers, first calving at 3 years

Baseline emissions



Mitigation modelled

Mitigation	Carbon footprint (kg CO_2 - eq/kg deadweight)	% Change (cumulative effect)
Baseline	35.73	
Increase no. of calves reared by 5%	35.23	**-1.40%**
Reduce age at first calving to 2 years	32.80	**-8.20%**
Reduce cow weight by 10%	32.45	**-9.20%**
Reduce age at slaughter to 18 months	28.41	**-20.50%**
Improve grassland management	26.15	**-26.8%**
Use methane inhibitor (3-NOP)	24.90	**-30.30%**
Improve manure and nutrient management	23.92	**-33.10%**
Nitrification inhibitor in artificial fertiliser	22.44	-37.20%

+

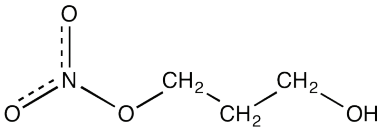
Overall, within this beef system, it was possible to reduce the carbon footprint by **37%** when all mitigations were implemented in this order.

Innovative solutions reducing methane emissions

Emerging dietary methane inhibitors were found to be very effective at reducing the carbon footprint of dairy, beef and sheep farms and while many are not yet available or not yet proven on UK beef farms, more products will become broadly accessible in the near future. However, use within grazed grass systems is a challenge yet to be overcome.

As more scientific investigation and innovation is still required to optimise their adoption and effectiveness, CIEL is working on various projects with industry and research to accelerate progress.

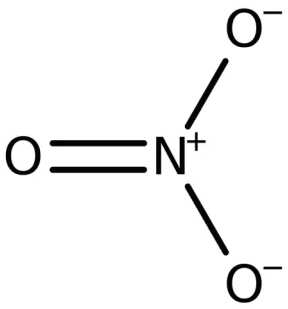
Here we offer a brief overview of the main options that could offer the most potential, highlighting the key pros and cons associated with each.



3-NOP

3-NOP (3-nitrooxypropanol) is a novel and specific small molecule that has been found to reduce CH_4 from cattle and sheep.

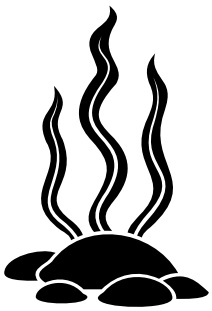
- Dose and application strategy needs to be tailored depending on the types of animals
- Currently, 3-NOP can only be used in conjunction with concentrate feeding, with only a very small amount (100 – 200mg/kg dry matter per day) needed
- Studies have found long-lasting improvements in animal performance (increased production of milk fat or milk protein)
- As a feed additive, 3-NOP still requires regulatory approval by various countries.



Nitrate

Nitrate (NO_3–) is another feed additive that reduces enteric CH_4 production. However, nitrate poisoning of ruminants and rumen microbes has been reported, so extreme care is required during incorporation to diets due to animal health concerns. Feeding nitrate could increase the concentration of nitrate and nitrite in milk and urine.

- Nitrate tastes bitter which lowers the palatability of diets and may cause lower feed intake, leading to lower levels of production
- Recent results showed promise in the use of nitrate as a feed additive in precision indoor feeding systems
- Use within grazing or non-total mixed ration systems presents a major challenge
- More work is required on the use of nitrate as a CH_4 reducing mitigation to manage any unintended detrimental impacts on the animal and its outputs.



Seaweeds

Seaweeds provide a large group of essential nutrients as well as numerous secondary plant compounds. Some of these secondary compounds have been found to reduce CH_4 emissions when offered to cattle & sheep and show promise as a future key mitigation strategy. Many studies continue to identify raw seaweed products as well as the active compounds responsible for the reduction in CH_4 emissions.

- Certain seaweeds also contain omega-3, omega-6 and other polyunsaturated fatty acids
- Algae-based feeds may improve the fatty acid profile of diets, increase the fat content and reduce somatic cell counts in milk
- However, seaweeds may also contain inorganic elements and heavy metals that, at high levels, may cause toxicity in animals and humans.

Taking practical steps towards net zero: **BEEF**

Complete regular carbon audits using a reliable carbon calculator

- Establish baseline
- Identify hotspots
- Monitor emission reductions and changes in carbon pools.

Deliver high production efficiency whilst maintaining high health status

- Reduce age first calving
- Optimise calving interval
- Reduce days to slaughter.

Improve quality and utilisation of forage

- Harvest early, increase grazing frequency, decrease regrowth interval, etc.

Maintain or enhance sward productivity, reducing need for artificial fertiliser

- Include legumes in pasture mix
- Promote soil health and fertility.

Adjust diet and consider carbon footprint of feed components and farm nutrient balance

- Increase starch & concentrate proportions.*

Focus genetic improvement on component traits

- Productivity relative to cow size
- Feed efficiency
- Fertility, longevity, health, growth
- Carcass traits.

Adapt approach to storing and utilising slurry or manure

- Additives can reduce emissions from stored manure
- Use additives to reduce emissions from stored manure
- Practice low emission slurry spreading
- Adopt precision application of manure and fertiliser
- Carry out soil testing.

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*within recommended guidance levels