An Attainable & Efficient Approach Towards Net Zero Livestock Emissions

Introduction

Methane is a powerful, but short-lived climate pollutant. Rapidly reducing methane emissions from energy, agriculture and waste products is regarded as the single most effective strategy to keep the goal of limiting global warming to 1.5˚C. This is within our reach, while improving public health and agricultural productivity.

Feeding and Nutrition

Improving forage quality

- Feeding coarse straws from millet, and corn/maize have better feeding qualities than slender straws. [4]

Dietary improvements and substitutes

- Feeding corn or legume silages starch or soya decreases methane production and increases feed intake and production in dairy cows as compared to grass silages. [3]
- Combining maize and legume silage also reduces nitrogen (N) excretion in urine, which can have both greenhouse gases (GHG) and water quality benefits.

Feed supplements

- By-product feeds with high oil contents increase feed efficiency, but their effects on productivity and product quality need further research. [5]

Livestock Health

Prevent, control & elimination of diseases

- Education, use of veterinary services, proactive herd health planning, and availability of efficient animal health diagnostic tools and therapeutics are key elements of prevention, early detection and treatment of disease.

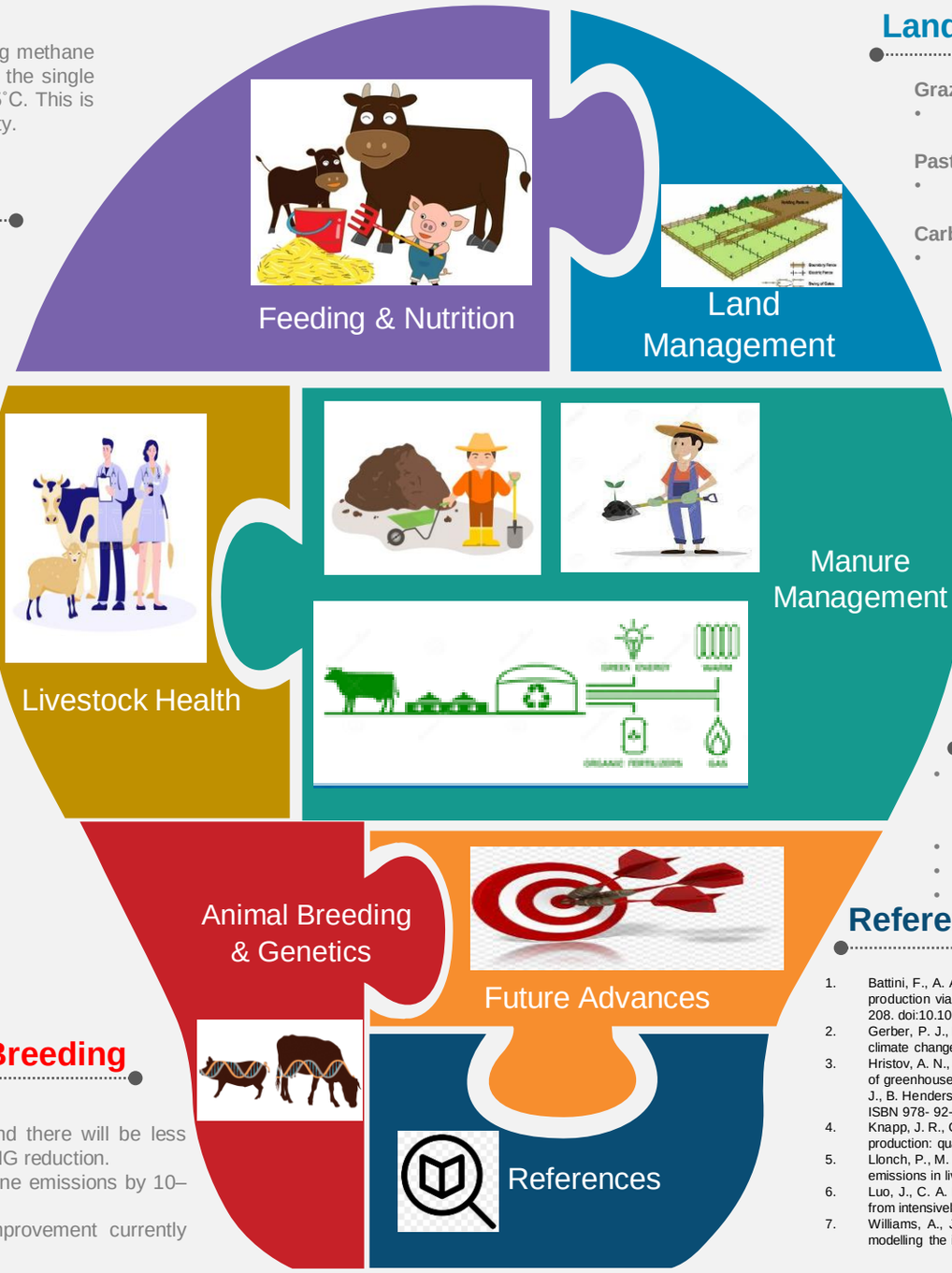
Increasing productive lifetime of animals

- Studies found that cattle diseases can increase greenhouse gas emissions up to 24% per unit of milk produced and up to 113% per unit of beef carcass. [7]
- Achieved by selective breeding, improved feeding and wider animal husbandry practices to prevent decline in productivity and premature culling of sick or underperforming animals.
- Improved conception rates, earlier time of first reproduction, increasing reproductive lifetime and adjusting overall lifetime to minimise overall GHG emissions per total product are the relevant approaches.

Animal Genetics & Breeding

Genetic selection of efficient & robust animals.

- New breeds and crosses retain more dietary nitrogen protein and there will be less nitrogen in faeces and the urine, [2] which can lead to substantial GHG reduction.
- Improved fertility in dairy cattle could lead to a reduction in methane emissions by 10–24% and reduced nitrous oxide by 9-17%.
- Benefits are permanent and over time, cumulative: genetic improvement currently accounts for 0.5 % to a 1% efficiency increase per animal per year.



Land Management

Grazing practices

- A combination approach is used, where animals graze during the day and housed during the night to improve grassland management.

Pasture management

- Rotational grazing and introduction of paddocks reduces stock density improves grassland regrowth. [6]

Carbon sequestration

- Sowing of improved grass varieties and restoration of peat-lands increase carbon sequestration.

Manure Management

Collection & storage

- Using feedlots improve collection of manure and urea, with the co-benefit of being able to use these nutrients as fertilizer. [3]
- Aeration of solid and liquid manure can substantially decrease CH4 and nitrous oxide emissions. Impermeable covers give the opportunity to flare CH4 or collect as biogas.

Organic fertilizer.

- manure is applied back to soils where it acts as a natural fertiliser& N2O emissions are greatly reduced. [1]

Biogas production

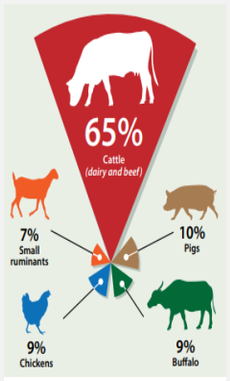
- Efficient biogas digesters avoid 60-80% of the CH4 emissions that would have occurred from manure otherwise. [1]

Future advances

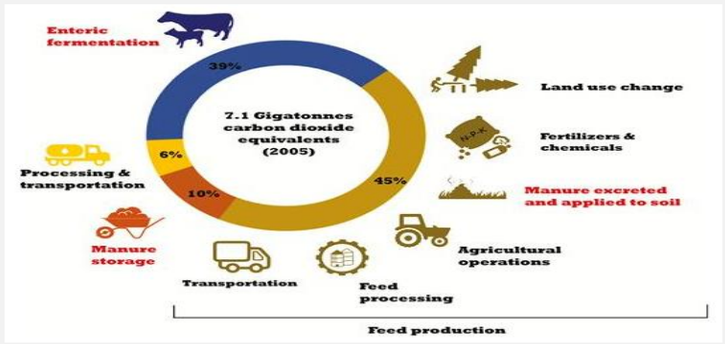
- Finding new traits for GHG emissions - breeding and selection programmes to select lower emitting animals by changing the rumen microbial composition.
- Transferring the microbiome of low methane producing ruminants.
- Vaccines to reduce methane production in the rumen.
- Increase disease resistance.

References

1. Battini, F., A. Agostini, A. K. Boulamanti, J. Giuntoli, and S. Amaducci. 2014. Mitigating the environmental impacts of milk production via anaerobic digestion of manure: case study of a dairy farm in the Po Valley. Sci. Total Environ. 481:196–208. doi:10.1016/j.scitotenv.2014.02.038
2. Gerber, P. J., H. Steinfeld, B. Henderson, A. Mottet, C. Opio, J. Dijkman, A. Falcucci, and G. Tempio. 2013. Tackling climate change through livestock: a global assessment of emissions and mitigation opportunities. Rome: FAO.
3. Hristov, A. N., J. Oh, C. Lee, R. Meinen, F. Montes, T. Ott, J. Firkins, A. Rotz, C. Dell, A. Adesogan, et al. 2013. Mitigation of greenhouse gas emissions in livestock production—a review of technical options for non-CO2 emissions. In: Gerber, P. J., B. Henderson. and H. P.S. Makkar, editors. FAO Animal Production and Health Paper No. 177. Rome (Italy): FAO. E-ISBN 978- 92-5-107659-0.
4. Knapp, J. R., G. L. Laur, P. A. Vadas, W. P. Weiss, and J. M. Tricarico. 201. Invited review: enteric methane in dairy cattle production: quantifying the opportunities and impact of reducing emissions. *J. Dairy Sci.* 97:3231–3261.
5. Llonch, P., M. J. Haskell, R. J. Dewhurst, and S. P. Turner. 2017. Current available strategies to mitigate greenhouse gas emissions in livestock systems: an animal welfare perspective. Animal. 11:274–284.
6. Luo, J., C. A. M. de Klein, S. F. Ledgard, and S. Saggar. 2010. Management options to reduce nitrous oxide emissions from intensively grazed pastures: a review. Agric. Ecosyst. Environ. 136:282–291.
7. Williams, A., J. Chatterton, G. Hateley, A. Curwen, and J. Elliott. 2015. A systems-life cycle assessment approach to modelling the impact of improvements in cattle health on greenhouse gas emissions. Adv. Anim. Biosci. 6:29–31.



Livestock greenhouse gas emissions per species (Lifecycle Analysis, Gerber et al., 2013)



Livestock emissions by source (adapted from Gerber et al., 2013). Direct livestock emissions are shown in red.

Acknowledgement

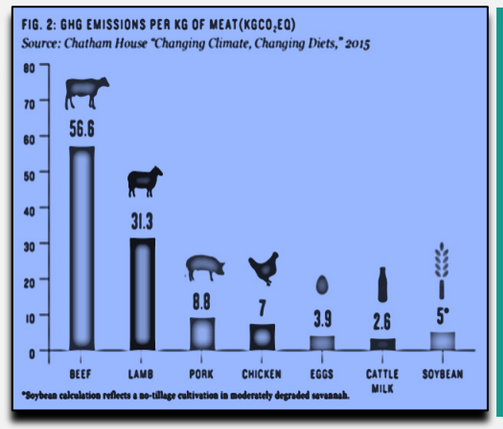
Owen Richardson
Intelligence Lead - Public Health
Kirklees Council

Michelle Bartholomew
Course leader MPH
University of Huddersfield

Baggialaxmi Kanagaraja

University of Huddersfield

Livestock numbers across the UK. Data source: Defra statistics.



According to Committee on Climate Change "To reach an overall target of net Zero carbon for the UK economy by 2050, emissions from the agriculture and land use sector must be reduced by 64%"