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HCC Carbon Footprint Report

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Contents

1. Background

Agriculture contributes to the environment in many valuable ways. However, it is also responsible for some negative environmental impacts; one of which is the release of greenhouse gases (GHGs). Livestock in particular are significant contributors to these emissions, and it is therefore important for the industry to determine how they could be reduced. The primary GHGs associated with beef and sheep production systems are methane, nitrous oxide, and to a lesser extent, carbon dioxide.

In the environmental roadmap[1], Hybu Cig Cymru outlines the strategies of how the Welsh red meat industry aims to reduce its environmental impact. To help meet these objectives, it is important to determine the change in GHG emissions on Welsh livestock farms over time.

'Carbon footprinting' is the way in which GHG emissions are measured per output of product; for instance the carbon emitted per kg of beef or lamb produced. Efficient livestock production systems are beneficial to the farmer since they represent lowered costs (e.g. of fuel) and/or greater production (output) (i.e. kg of produce). Efficient systems also have smaller carbon footprints; hence they have both economic and environmental benefits. Past studies have shown that the carbon footprint of both beef and lamb varies substantially. As well as production efficiency, the size of beef and lamb carbon footprints can be affected by factors such as the weather, disease, and soil type.

In this study, data was collected for the year 2012/13 from a set of 15 Welsh farms that'd had their carbon footprint analysed three years previously. The aims of the research were to investigate if, and how their carbon footprints had changed between the sampling years; and to determine the most important factors between farms with large and small carbon footprints. The findings would help to understand how to reduce farm carbon footprints, for the benefit of farmers and the environment.

[1] HCC (2009) A Sustainable Future – The Welsh Red Meat. Hybu Cig Cymru, Aberystwyth.

2. Results

2.1. Annual comparisons

The carbon footprint of each farm was assessed by the Bangor University model[2][3], which includes all the GHG emissions associated with producing 1 kg of liveweight (beef or lamb) from the time that an animal is born, until the time it leaves the farm for slaughter. The unit used to measure the footprint is kg CO_2eq/kg liveweight (kg CO_2eq/kg lw). The model uses a vast array of information of on-farm management practices and animal numbers to produce a final carbon footprint of each farm per 1 kg of slaughter liveweight produced.

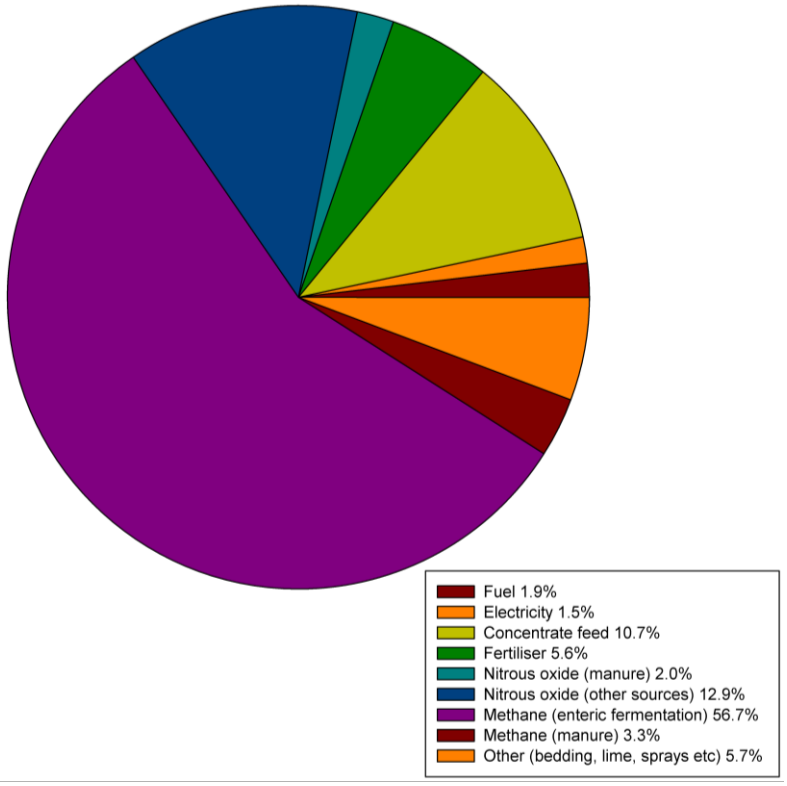
It was found that the average carbon footprint for lamb increased (+12%) between 2009/10 and 2012/13; whereas the average footprint of beef decreased (-13%).

There were no significant differences in the model inputs between the two sampling years. However, the change in emissions for both beef and lamb can be explained by the total volume of slaughter liveweight produced for both years. In 2012/13, lamb production was less that in 2009/10, while beef production increased. As production systems become more efficient, emissions are spread over increased units of production and the carbon footprint decreases. Therefore, since total lamb slaughter weight was less in 2012/13 compared to 2009/10, its carbon footprint increased; whereas the carbon footprint of beef decreased as beef production increased. A breakdown of the average emission sources which contributed towards the final footprint are shown on the following page:

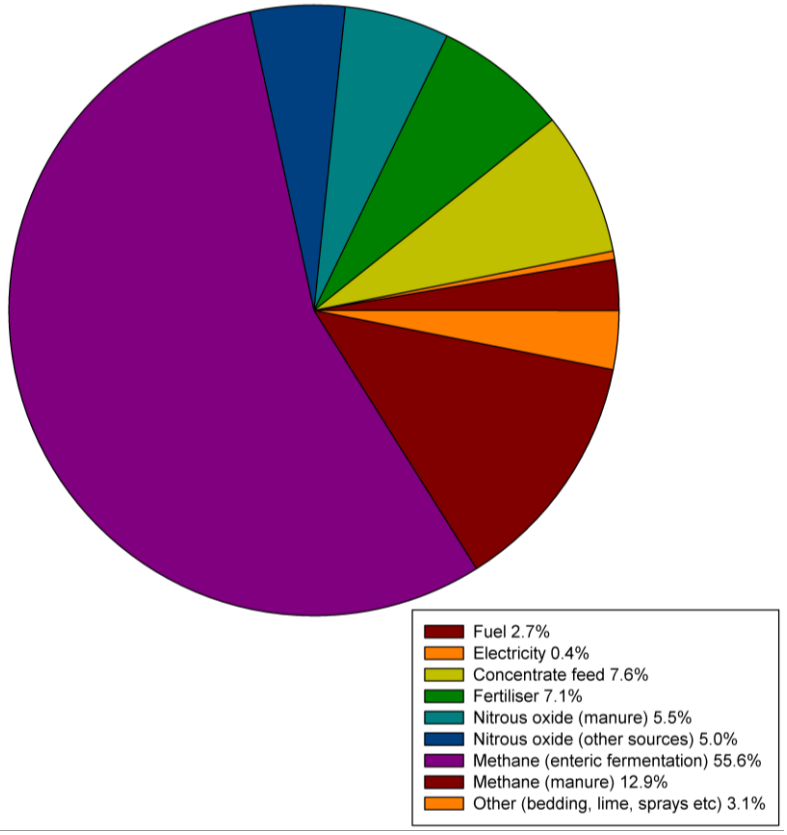
[2] Edwards-Jones, G., Plassmann, K. & Harris, I. (2009) Carbon footprinting of lamb and beef production systems: insights from an empirical analysis of farms in Wales, UK, *The Journal of Agricultural Science* 147, 707-719.

[3] Jones, A., Jones, D. & Cross, P. (2013) The carbon footprint of lamb: Sources of variation and opportunities for mitigation, *Agricultural Systems* 123, 97-107.

Lamb: Breakdown of source emissions



Beef: Breakdown of source emissions



2.2. A comparison of high and low-emitters

One of the most effective measures to reduce farm GHG emissions is for the highest emitting producers to adhere to the practices and approaches adopted by those lowest emitters. This study therefore compared the 25% of farms with largest emissions against the 25% of farms with the lowest emissions to see what explained these differences.

The most important factor between both sets of emitters was the amount of time that livestock were on farms before being sold for slaughter. Hence, farms with the largest emissions required a higher population of livestock to produce 1 kg of liveweight for slaughter (i.e. had lower kg of output per head of livestock).

2.3. Scenario analyses

The study also explored how changes in management practices may alter the carbon footprint of beef and lamb. A scenario analysis represents how a change in farm management practice may alter the emissions associated with production when there is no change in other aspects of production. The management altercations that were examined included: reduce concentrate feed use, reduce fertiliser bought and applied, the adoption of low-emission manure management systems (e.g. anaerobic digestion), and for all enterprises to match the production practices of the 25% least-emitting producers.

The most effective method for enterprises to decrease their carbon footprint was through reducing the time taken to take animals to slaughter. If all enterprises were able to get their stock to slaughter as quickly as those low-emitting farms, emissions would diminish by 15% and 30.5% for beef and lamb, respectively. The impact of this measure far exceeded the other scenarios assessed.

3. Discussion and conclusion

The winter of 2012/13 was particularly harsh and may have impacted on beef and lamb production in alternative ways. The poor winter weather resulted in growth rates being compromised for lambs slaughtered in 2013. This may explain the rise in the average lamb carbon footprint in 2012/13 compared to 2009/10. Lighter liveweights cause greater emissions associated with producing 1 kg of liveweight for slaughter; this is because the total emissions are spread over a smaller animal when all other aspects of production stay the same.

The difficult winter weather conditions of 2012/13 also had impact nationally on the number of cattle brought to slaughter. UK producers were faced with rationing their herd in the face of high input costs and concerns over forage availability. Furthermore, the horse-meat scandal of 2013 assured demand for beef was high, with many UK farmers taking advantage of the strong market conditions. Such factors led to a significant impact on the number of cattle brought to slaughter in the UK during the first four months of 2013. This may explain the increase in total slaughtered beef liveweight sold in 2012/13 in comparison to 2009/10 on the farms assessed in this study. High feed cost and good market conditions meant that farmers may have sold their stock as soon as they were ready and therefore reduced their carbon footprint as animals spent less time on-farm.

Although the UK red meat sector has increased in efficiency over the last few decades[4], there are significant differences in the efficiency levels of the most and least efficient farms[5]. In this study, it was observed that, at similar input and production levels, that higher emitting enterprises carried a higher supporting population of animals to produce 1 kg of liveweight for slaughter.

Considering an increasing global population and the predicted demand for red meat in the coming decades, it is important to reduce the sector's emissions while not compromising production levels. Therefore, rather than reducing livestock numbers, improving the efficiency of livestock production is essential to reduce emissions. Efficiency improvements can be achieved in multiple ways[6]:

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[4] Defra. (2014) *Total factor productivity of the UK agricultural industry 2013 – 1st estimate*. London: Department of Food and Rural Affairs.

[5] Pullar, D., Allen, N., & Sloyan, M. (2011) Challenges and opportunities for sustainable livestock production in the UK. *Nutrition Bulletin,* 36, 432-437.

[6] Farming Futures (2010) Fact sheet 7: Profitable business in a changing climate. Farming Futures, Cambridge.

- Optimising the number of calves/lambs per cow/sheep. This makes good business sense and reduces emissions.
- Utilising well balanced rations to reduce the cost per kg of liveweight gain, while improving growth rate and feed conversion efficiency. This reduces the amount of time that an animal spends on farm before slaughter.
- Selecting stock with good genetic potential to improve growth rate and carcass characteristics. The use of Estimated Breeding Values (EBVs) and Genetic Breeding Values (GBVs) can be adopted to ensure the selection of favourable genetic traits.
- Incorporating legumes into grass leys. Legumes like red and white clover have the capacity to fix nitrogen from the atmosphere (therefore reduce the need for bagged fertiliser) and have a higher protein content than grass monocultures.
- Implementing 'Farm Health Plan', as such a measure can help prevent disease and improve the performance of livestock.

By undertaking the measures outlined above, farmers could improve production efficiency parameters; therein, enabling the industry in meeting the objectives set in the Hybu Cig Cymru environmental roadmap.

4. Acknowledgements

Bangor University would like to thank Hybu Cig Cymru and the Knowledge Economy Skills Scholarship programme for their funding of a PhD studentship to complete this work. Special thanks to all the farmers who took part in the study, over two time points. It is important that the industry can regularly assess carbon footprints; without their full cooperation it would have not been possible for such a study to take place.