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Inside this Quarter

TACKLING GHG EMISSIONS FROM AGRICULTURE: A PARTNERSHIP APPROACH

THE NI Greenhouse Gas (GHG) Implementation Partnership was established in 2010 following lobbying from industry to ensure that NI agriculture was seen to be proactive in addressing its GHG emissions.

The GHG Implementation Partnership represents agriculture generally in NI and includes sub-sector committees for the red meat, arable and dairy sectors. The Red Meat sub-committee of the GHG Implementation Partnership is an excellent example of the supply chain and government working in partnership and comprises membership from the Ulster Farmers Union, National Sheep Association, National Beef Association, NI Meat Exporters Association, LMC, DARD, Cafre and AFBI. The Red Meat sub-committee is committed to ensuring that the NI red meat industry makes progress on measuring and mitigating GHG emissions while ensuring that this progress does not act as a constraint on the development of the sector. For this reason, this issue of LMC Quarterly is providing producers with further information about steps that can be taken to simultaneously improve both profitability and reduce GHG emissions.

The Red Meat sub-committee is also active in communicating with key stakeholders outside of agriculture to ensure that all parties to the debate are properly informed.

With poor weather, tight margins, rising input costs and looming CAP reform, the impact of red meat production on the climate through GHG emissions is probably a fairly low priority for many producers at the present time.

While producers are obviously concerned with many short and medium-term challenges it often pays to consider longer-term threats to the sector. The climate change issue is one that the industry cannot ignore.

The challenge

Many of the industry's customers are placing an increasing emphasis on environmental sustainability while the media has been awash with negative messages about the environmental cost of red meat consumption. The EU has introduced legislation which sets targets for reductions in GHG emissions and further legislation and targets are possible at global, national and regional levels.

A proactive response

Through the GHG Implementation Partnership and other initiatives, the industry has pioneered a voluntary approach to promote more carbon efficient red meat production in Northern Ireland. By taking this approach, the red meat sector has an opportunity to tackle the issue on its own terms and provide essential reassurance to its customers and those legislators who may be tempted to impose compulsory climate change targets upon the industry.

Measuring GHG outputs

To improve the carbon efficiency of red meat production the industry must first ensure that the measurement of its GHG outputs is robust and comparable on a regional and global basis. AFBI is a world leader in this regard and the NI industry is working with partners on a global basis to ensure the development of a global standard for measuring agricultural emissions. Details about this essential research are provided on page 4.

The Win-Win

Simultaneously, the industry has been working to establish the technical measures that could be implemented at farm level to reduce the industry's carbon footprint. These were outlined in a 2010 report, published by the Greenhouse Gas Implementation Partnership. This report, which was titled "Efficient Farming Cuts Greenhouse Gases", had a clear message: By improving efficiency producers will improve their profitability and reduce their carbon footprint.

On Pages 2 - 3, CAFRE advisors provide detailed information on a range of measures that can be taken to improve technical efficiency, profitability and reduce the GHG emissions from the red meat sector.

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IMPROVED TECHNICAL EFFICIENCY

cafre
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THIS article provides an introduction to the practical technologies, which you can be adopted in order to reduce the carbon footprint of your business. The majority of management tips in this bulletin reduce emissions and save money, so are regarded as a win-win situation for the environment and profitability.

Introduction

Three main greenhouse gases (GHG's) are emitted by the agri-food industry:

- Carbon dioxide (CO_2) emissions from fossil fuel usage (diesel, electricity) and soil disturbance when cultivating.
- Methane (CH_4) emissions from ruminant livestock and manure storage.
- Nitrous Oxide (N_2O) emissions from nitrogen fertiliser, manure applications and turnover of nitrogen in the soil when cultivated.

Gas emissions are rated in terms of their Global Warming Potential (GWP) with CO_2 given a base of 1, CH_4 is 23 times, and N_2O 296 times more potent than CO_2.

The term carbon footprint is used to describe the total amount of CO_2 and other gases emitted when a product is produced. CO_2 equivalents are a measure of the level of greenhouse gases given off per tonne of grain, kg of beef or litre of milk produced. In general the higher the yield or the better the liveweight gain, the lower the carbon footprint per unit of production.

A unique aspect of the agri-food production system is the ability to absorb some of the CO_2 produced through accumulation of CO_2 in plants, trees, and peatland, by carbon sequestration. The term 'carbon sink' or 'carbon sequestration' refers to the ability of these land use types to capture CO_2 from the atmosphere. How land is managed plays a big part in the levels of CO_2 absorbed. Initial calculations show 6% of agricultural emissions can be offset. There is ongoing research to quantify the extent of land sequestration.

In order to reduce GHG emissions, the agri-food industry can reduce direct emissions, substitute fossil fuels with renewable energy sources and enhance carbon sequestration.

Livestock efficiency

Improving the technical performance of livestock systems lowers costs of production and reduces carbon emissions per kg of carcase produced. The key areas for farmers to focus on include fertility, genetic selection, health and welfare, feed efficiency and analysis of the current production system operated.

Fertility

Fertility is key to livestock profitability; by improving fertility you will ultimately reduce replacement rate and maximise output per breeding female. Maximising output per breeding female increases output per given level of inputs. Infertility leads to a financial cost per breeding herd. It is calculated as the cost of keeping a non pregnant breeding female. For example the cost for each day that a suckler cow is empty is £2.50.

Genetics

Genetic selection for food conversion efficiency produces higher live weight gains per kg of feed. The use of breeding tools for genetic selection is crucial when selecting sires. Select beef sires for increased 200 and 400 day weights; use beef breed plan figures.

Health and welfare

A positive proactive approach is required to maximise performance. Herd Health plans are essential as prevention is better than cure. Focus on welfare of housed livestock, paying particular attention to cow comfort and feed space allowances. Prevent lameness by routine paring/foot bathing. The eradication of diseases like BVD will reduce the number of expensive herd replacements that are needed and reduce the methane (CH_4) emissions from replacement heifers. Reducing disease levels will also increase stock performance and further reduce the carbon footprint per Kg of carcase weight.

Feed efficiency

Grazing livestock feed efficiency hinges on the stock carrying capacity of the farm. Stocking rate is based on both the production and utilisation of quality forage.

Target liveweight gains at grass for beef and lamb:

- Aim for 200kg liveweight gain/ beef store animal over the grazing season;
- Aim for 300grams per day/lamb pre weaning.

Forage utilisation and farm profit

The CAFRE Benchmarking database has been analysed to examine the relationship between measures of farm profitability and forage use.

On beef and sheep farms there is a direct relationship between forage utilisation and gross margin. Each 100kg of beef gained from forage is worth an extra £100 of gross margin per suckler cow and for every 10kg of lamb produced from forage, this generates an extra £15 gross margin per ewe (CAFRE Benchmarking 2009).

Land management

The management of farm land soil pH can play a pivotal role in cutting greenhouse gas emissions. Best practice is good for the environment and saves money; it's a win-win situation. Areas to consider include drainage, lime status, crop establishment techniques and improving grass swards without ploughing. Well managed land can offset carbon emissions as it acts as a carbon sink; this is unique to the agricultural industry.

Drainage

Sub- soiling grazing or arable land reduces compaction and helps aerate plant roots, reduces water logging and has the added benefit of reducing CO_2 losses. It also improves nutrient uptake with organic/inorganic fertiliser nutrients being more efficiently used by the crop. As a result there is a reduced fertiliser input for same level of output.

Soil pH

It is good business practice to soil sample and apply lime as per recommendations. Land that has a pH of between 6.0 - 6.5 ensures that nutrient uptake by the growing plant is maximised. Where the pH is 5.5 only 77% nitrogen applied is available to plant, with the remainder being lost to the atmosphere as N_2O. Lime improves flocculation in clay soils, enhancing drainage. Productive clover and ryegrass varieties are more persistent in soils of pH 6.0-6.5.

MIN-TIL crop establishment

Reduces fuel usage due to fewer cultivation passes during establishment. Shallower tillage leads to less soil disturbance, resulting in less GHG loss from the soil. To enhance productivity with minimum soil disturbance,

Continued on Page 3

HELPS TO OFFSET GHG EMISSIONS

Continued from Page 2

cultivate soil when moist, friable and workable.

Grass sward rejuvenation

Introduce modern ryegrass and clover varieties into soils with pH 6.0-6.5. Establish via over seeding or slot seeding. Swards should be sown either in April or August for optimum clover seed germination. The overall result is that it leads to fertiliser savings and reduced nitrous oxide emissions (N2O). In financial terms 50kg nitrogen/hectare/year input to a grass/clover sward with 10-20% clover produces similar output of beef or lamb as a pure grass sward receiving 180-200kg nitrogen/hectare/year. Data for a dairy origin steer system showed that replacing a pure grass sward receiving 150kg N/Ha with a grass/clover sward receiving no fertiliser reduced the carbon footprint in terms of Kg carcase weight by almost 20%. In addition high clover content swards reduce worm burden, increase trace element availability, lose quality more slowly than grass, contribute to greater herbage intake and up to 25% higher live weight gain in lambs.

Nutrient Management Planning

The faeces and urine from housed livestock contain substantial quantities of the major nutrients, nitrogen (N), phosphorus (P), potassium (K) and sulphur (S), which can be recycled for crop and grass growth.

Nutrient Management Planning (NMP) to ensure that these nutrients are utilised efficiently on the farm will minimise the quantities of additional fertiliser the farmer must purchase for crop and grass growth. In addition to making good economic sense, efficient nutrient management planning may also reduce greenhouse gas emissions.

Reducing the quantity of chemical fertiliser purchased will reduce the fossil fuel derived carbon dioxide emissions associated with the manufacture of nitrogen fertiliser, which is a highly energy dependent process. Targeting slurry and farmyard manures according to soil analysis and crop requirements will reduce the need for additional phosphorus and potassium. This will reduce the use of fossil fuel energy to mine, process and transport these nutrients to the farm.

A proportion of the nitrogen contained in fertiliser, slurry and manure will be released to the air as nitrous oxide (N2O). The quantity of nitrous oxide released depends on how soil, fertiliser, slurry and manure nitrogen is managed on the farm. Nitrous oxide has been found to be 296 times more potent than CO2 in its impact on climate change. Therefore, the management of soil, fertiliser, slurry and manure to minimise nitrous oxide release is important. Farmers should:

- Target slurry and manure applications to crops and fields requiring additional nutrients.
- Delay applying fertiliser N until at least 4 days after slurry.
- Apply slurry using equipment to minimise nutrient losses.
- Use appropriate chemical forms of nitrogen fertiliser according to the weather conditions.

Further details are provided below:

Targeting slurry and manure applications to crops and fields requiring additional P, K and S

Grazing animals return substantial quantities of the major nutrients to the soil through their faeces and urine. In general, fields that are mainly grazed have much less need for applications of slurry or farmyard manure than fields cut for silage or used for growing crops. Livestock farmers should therefore target the majority of their slurry and manure to fields cut for silage and other crops.

Timing of slurry and fertiliser applications

Recent research carried out by AFBI has demonstrated considerable reductions in nitrous oxide emissions through applying slurry 4 to 5 days before fertiliser application.

Method of slurry application

Research at AFBI, Hillsborough, carried out over the last 10 years has shown that alternative slurry spreading systems, such as the trailing shoe and band spreading, can reduce the losses of ammonia from slurry. While ammonia is not a greenhouse gas itself, it can be an indirect source of nitrous oxide, if re-deposited on land. Reducing ammonia loss will reduce the quantity of chemical fertiliser required, which is economically beneficial for both farmer and environment.

Chemical form of nitrogen fertiliser applied under different weather conditions

The two most commonly used chemical forms of nitrogen fertiliser in Northern Ireland are Calcium Ammonium Nitrate (CAN) and Urea. Under wet application conditions, the loss of nitrous oxide is higher from CAN than with Urea fertiliser. Under dry, warm conditions, losses of ammonia from Urea are higher than with CAN fertiliser, therefore use of Urea should be restricted to the early spring. Further research is being undertaken by AFBI to look at alternative forms of fertiliser N which will result in less ammonia loss under warm, wet conditions.

Summary

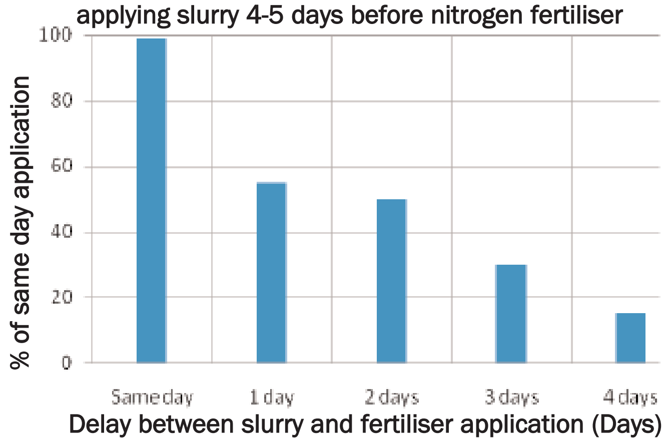
- Reducing the amount of carbon you emit can help save your business money as well as helping the environment. Small changes can make a big difference.
- Improving the technical performance of livestock systems lowers costs of production and reduces carbon emissions per kg of carcase produced.

- The management of farm land soil pH can play a pivotal role in cutting greenhouse gas emissions.
- The faeces and urine from housed livestock contain substantial quantities of the major nutrients. Ensuring that these nutrients are utilised efficiently on the farm will minimise the quantities of additional fertiliser the farmer must purchase for crop and grass growth.

Useful contacts:

Farmers requiring advice should contact their locally based CAFRE Development Adviser.

Figure 1. Reduction in nitrous oxide emission through applying slurry 4-5 days before nitrogen fertiliser



AFBI PIONEERING GHG RESEARCH IN NI

THE Agri-Food and Bioscience Institute (AFBI) along with other research partners from across the UK are playing a major role in addressing the pressing issues of GHG emissions from agriculture. In 2010, a major project funded by DEFRA, DARD and the Scottish Government was initiated to establish a more accurate UK national inventory of GHG emissions which can then provide the basis for the agricultural industry to gain recognition for mitigation strategies (http://www.ghgplatform.org.uk/).

Over the last 20 years AFBI research has measured, using calorimetric chambers, methane emissions from livestock offered a range of indoor diets representative of those offered to livestock within Northern Ireland. This valuable resource, which includes data from over 1100 dairy cows, 250 beef cattle and 50 sheep has been collated into a dataset, alongside data from other research centres within the UK and will be modelled to predict methane production under a range of management regimes. However, within this dataset and the scientific literature there are also important knowledge gaps which are currently been assessed. These include emissions from:

- Grass-based dairy systems
- Dairy, beef and sheep young stock
- Extensive hill/upland beef and sheep systems
- Livestock manures, soil (under Northern Ireland) conditions, fertilisers

In addition to continuing to measure methane emissions using large scale calorimetric chambers, AFBI has recently constructed 6 new sheep chambers to determine emission factors from lowland and hill ewe replacements, and lactating ewes. These chambers will examine emissions from various breeds types representative of the Northern Ireland flock under a range of dietary regimes. Also, AFBI along with other partners within the research consortium have over the last two years focused on developing and refining alternative techniques for measuring methane emissions from free-ranging livestock. Projects are currently underway measuring methane emissions from a range of grazing livestock types under differing management regimes, for example:

- Lactating suckler cows offered upland (Less Favoured Area) pasture or lowland pasture
- Dry suckler cows offered grass silage based diets
- Growing beef cattle (both dairy and suckler origin) on a range of grazing environments
- Finishing beef cattle offered a range of forage and concentrate diets
- Grazing dairy young stock from 4 to 23 months of age
- Grazing dairy cattle offered a range of concentrate feed levels
- Dry dairy cattle

Local funding, through the DARD Evidence and Innovation programme with co-funding from AgriSearch has enabled research to commence to establish the baseline GHG footprint per kg beef produced for a range of Northern Ireland beef production systems. This modelling work will examine the impact of GHG mitigation strategies from beef cattle fed and managed under different beef production systems. Similar funding has enabled a study involving over 2000 ewes (located on both hill and lowland farms) to commence to evaluate the impact of sheep breeding strategies on GHG emissions. A DARD Research Challenge Fund project with AgriSearch involving 11 Northern Ireland commercial beef farms has led to the development of an online growth monitoring tool for various beef production systems to help improve beef production efficiency and thus reduce GHG emissions. Furthermore, AFBI researchers are in the final stages of developing online tools which will enable each dairy and beef farmer in Northern Ireland to calculate their GHG emissions and investigate the impact of mitigation strategies.

In summary, AFBI research is addressing knowledge gaps to ensure greenhouse gas emissions from agriculture can be accurately monitored at national and individual farm level. Research findings will be instrumental at identifying cost effective mitigation strategies for Northern Ireland agriculture which will further reduce the carbon intensity of local food production whilst safeguarding our food production capacity.

Figure 1. Measuring methane emissions from a free-ranging heifer on LFA pasture

Figure 2. AFBI's calorimetric chambers used for measuring methane emissions