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Reducing Greenhouse Gas Emissions from Grassland



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Profitable and sustainable farming is the ultimate aim of any farm business. Minimising the environmental impact of production by reducing emissions and adapting to climate change, while at the same time achieving the increases in production that are needed to feed a growing population presents a massive challenge to the industry. However it is not a challenge to be ignored. Taking action and being proactive not just as an industry but as individual farmers will mean that we can start to reduce emissions from the agricultural sector and develop businesses that are more resilient to future challenges.

This starts by identifying the main sources of emissions on-farm and developing strategies to reduce them. The good news is that this also makes good business sense in terms of improving efficiency and may provide an advantage in terms of marketing produce to consumers who are more and more concerned by climate change.

Careful management of grassland systems can have a significant impact on the carbon footprint of the farm. European grassland based systems have changed considerably over the last two decades and will continue to evolve in response to societal and environmental pressures. Grass and forage production will need to keep pace not just with requirements for higher meat and milk production, but also preserve and enhance biodiversity and wider 'ecosystem services'.

So how do we do this? Is there a balance to be had between profitable farming and minimising emissions? The good news is that there are some easy steps that all farmers can take that will not just reduce emissions but will increase the production efficiency of the farm system at the same time.

Maintain a good soil structure

Soil underpins the entire farming system. A healthy well-managed soil that accumulates organic matter will sequester carbon, have improved soil structure and increase productivity, a win, win, win situation. Maintaining a good soil structure by avoiding grazing or travelling on wet soils and minimising compaction will enable better crop growth. Building your soil organic matter content will increase not just the carbon sequestration potential, but also the water holding capacity and structural stability of the soil.

Sequestering soil carbon has huge potential in terms of mitigating climate change from agriculture. Grassland is potentially the best vegetation for building soil carbon levels. This is because of the

continual supply of organic matter both from leaf and root decay. The mix of species in the ley are important to maximise growth rates, increase rooting depth and have a good balance of species for animal diet and soil structure. Every hectare of land that raises its soil organic matter levels by just 0.1% will sequester 8.9 tonnes of CO₂ per year.

The importance of soil organic matter in maintaining soil structure and a productive farming system cannot be underestimated. The levels of organic matter can be built with permanent pasture (preferably of mixed species), green manures and regular additions of manures, composts and other sources of organic matter. Variety of organic matter sources is important in order to provide food to the diverse population of organisms, nutrients for plant uptake and to support aggregation of soil particles.

Use cover crops

Cover crops are crops primarily grown to provide ground cover, rather than leaving bare soils, and also provide an addition of organic matter. Their use through the winter months to protect the soil will prevent nutrient losses through nitrate leaching, and the loss of soil particles and sediment (including phosphate) through run off and erosion. This loss of nutrients and soil can have an adverse affect not just on water quality and diffuse pollution, but this release of nitrates from the soil will increase nitrous oxide emissions (300 times more potent a GHG than Carbon dioxide). Cover crops have many positive benefits to the farming system, and if they are ploughed in, they can increase the soil organic matter content of the soil (sequestering more carbon).

Use clover and other legumes as fertility builders

The use of clover and other legumes as a nitrogen source is something that has been practiced by organic farmers for centuries. However due to rising costs of Nitrogen fertiliser and the negative associated environmental impacts of its production and use, it is becoming an increasingly attractive proposition to all farmers.

Legumes offer important opportunities for sustainable grassland based production because they can contribute to important key challenges by increasing forage yield, substituting inorganic N fertiliser inputs with symbiotic N fixation and supporting adaptation to climate change and increasing the nutritive value of the herbage.

Legumes fix Nitrogen, and therefore are associated with N_2O emissions. However they also build organic matter in soils, at potentially large quantities. These increases in soil organic matter sequesters far more soil carbon than any N_2O emissions.

Reduce tillage

There is definitive evidence that the fewer number of passes across the field, the lower the ground pressure of machinery and the less disturbance of the soil with each pass, the lower the GHG emissions are from the soil.

The reduction in emissions occurs primarily as a result of the effects of cultivation on soil organic matter. When the soil is cultivated, it allows oxygen to enter the soil which stimulates the soil microbes and oxidises the organic matter, which then emits carbon dioxide. Reducing the frequency, depth and intensity of cultivations results in less organic matter being oxidised and allows for higher levels of carbon sequestration in the soil.

Nutrient management planning

Improved nutrient management has a significant and cost effective role in profitable farming systems. By planning nutrient applications (either by fertiliser or organic manures), it is possible not just to minimise GHG emissions through reduced use of fertilisers (especially nitrous oxide) but also reduce the levels of diffuse water pollution and improve profitability.

The main goal of nutrient management planning is to match applied nutrient supply to crop requirements taking into account soil conditions (including soil pH). There are various nutrient management planning tools that are available to help with the planning process.

Timing of fertiliser and slurry applications

Following on from planning fertiliser and manure applications, applying them at the right time is the crucial next step. Ensuring that they are applied at times when they can be taken up by the actively growing crop will ensure that the nitrate is not sitting in the soil risking leaching or being released as nitrous oxide. Urea applications are more prone to the loss of ammonia in windy weather as the moving air increases ammonia volatilisation from the soil. However it is more suitable as an early spring fertiliser as it is less susceptible to GHG emissions from high soil moisture levels.

Research is ongoing into other options to minimise emissions from fertiliser applications including the use of nitrification inhibitors. Nitrification inhibitors have the potential to reduce the direcrt nitrous oxide emissions from each of these sources and also to reduce nitrate leaching losses which will reduce indirect nitrous oxide emissions. Research in New Zealand has shown significant reductions (up to 90%) in nitrous oxide emissions and nitrate leaching losses through the use of Nitrification inhibitors. In the UK a Defra research project is due to report over the next few months on the efficacy of these products under UK conditions.

The Farm Carbon Cutting Toolkit (FCCT) is the UK's only farmer led organisation looking at practical, farm based actions to effectively reduce farm greenhouse gas emissions. It aims to raise awareness of GHGs within the agricultural industry and also to provide practical responses that any farmer, whatever their farming system could put into place on their farm.

For more information please see the website at www.farmcarbontoolkit.org.uk

Cotswold Seeds has a range of mixes related to the issues covered in this piece:

Sainfoin - which helps reduce methane emissions, improves the efficiency of nitrogen use and benefits soil management - sainfoin

Herbal Ley and Legume and Herb Rich Sward - these high diversity mixtures are particularly good for soil improvement and have a positive environmental impact as well as giving a balanced protein rich diet - Herbal Leys

Green Manure mixtures - Fertility Builder and Humus Builder, are good for medium and long term soil management - Green Manures.

While Over-Winter Rye and Vetch is good for soil improvement and nutrient management - /products/1042/rye-vetch-over-winter-mix

The Cholderton is a dual purpose grazing and cutting mixture -/products/1135/cholderton-mix-four-year-plus-grazing-cutting-ley

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Date Posted: 11th June 2014