What is my carbon footprint?

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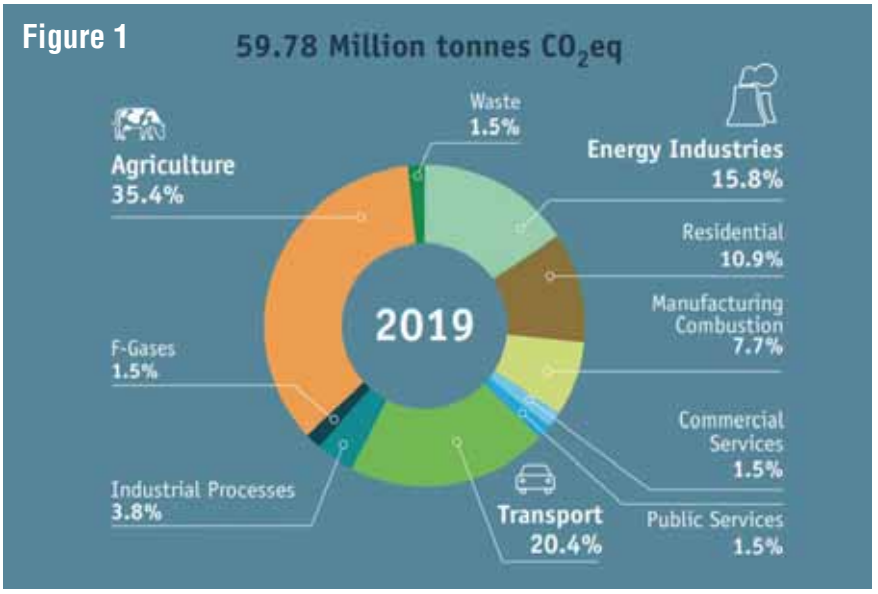
There has been much talk about the carbon footprint of beef but what, if anything, can we as suckler farmers do to improve it?

In my experience, greenhouses are not that common on suckler units but farmers are aware that these greenhouse gases (GHG) allow heat from the sun to come into, but not exit, the atmosphere…hence we get warming like in a greenhouse, or a car on a hot day. If it continues, the consequences for the planet are dire.

Carbon footprint is defined as the amount of greenhouse gas (GHG) emissions (carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4) associated with the production of a specific type of agricultural produce', expressed as kg CO_2 equivalent (CO_2eq) per kg produce (e.g. per kg of beef or milk).

For every kilo of beef that sits on a shelf in a supermarket, it has a rating as to how much GHG were emitted to the atmosphere to produce that kg of beef.

Unfortunately, in Ireland, agriculture is responsible for 35.4% of all GHGs produced. This is compared to 20.4% for transport, the next biggest emitter of GHG. See Figure 1, Source EPA Ireland's GHG emissions 2019.



What are the main GHGs produced in agriculture?

- Methane – 68% of total agricultural emissions in Ireland.
- Nitrous oxide – 29.3% of total agricultural emissions in Ireland.

Carbon dioxide is the other GHG. However, it is mainly derived from fossil fuel combustion and conversion of natural vegetation to managed land.

In Ireland carbon dioxide accounts for only 2.7% of GHG emissions from agriculture. This is mainly from liming, spreading urea and ploughing. Therefore, we will concentrate on methane and nitrous oxide.

How are methane and nitrous oxide produced?

Methane is a byproduct of the digestive process of ruminants, i.e. cattle, sheep and goats. In the rumen, bugs break down forage, a byproduct is biogenic methane gas. The more fibrous the material, the more methane that is produced.

Approximately 95% of this gas passes out in the breath of the animal, only 5% comes out the other end.

Stored animal manure is also a source of methane. When slurry is stored in anaerobic conditions the bacteria in the slurry break down the organic content and release methane.

Nitrous oxide (N_2O) is a gaseous form of nitrogen produced in the soil when microbes break down nitrogen (N). It makes up the other 29.3% of GHG emission from agriculture in Ireland. The main sources are:

- The application of synthetic fertilisers on pastures – 38%.
- Animal excreta deposited during grazing – 23%.
- The spreading and storage of slurry and FYM – 14%.

The rate of N lost from pastures in the form of N_2O are dictated by environmental conditions that favour microbial activity such as:

- Wet soil conditions.
- Rainfall.
- High soil temperatures.

Now that we know what GHGs are and how they are produced, we can look at what methods are there to reduce them:

- **Methane:** the less time an animal is ruminating, the less methane they can produce. So we need better lifetime performance in all animals. For the suckler cow, we must aim to have only productive cows in the herd – a calf per cow per year and all heifers calving at two years of age.

Once we have a calf on the ground, that calf must have excellent average daily gains, which will lead to a lower age at slaughter. These targets are achieved through better breeding, better grassland management, better health and better nutrition at housing. Ongoing research into feed additives may help in the future to reduce methane emissions

We also need to look at manure management– reducing the amount of slurry produced by extending the grazing season and reducing the age at slaughter. The slurry that is produced should be stored properly and for the least amount of time. Current research on slurry additives may also help in the future.

- **Nitrous oxide:** reduce the amount of synthetic fertiliser you have to apply by improving the soil fertility, in particular the soil pH. Change the form of nitrogen applied from CAN fertiliser to protected urea, incorporate clover and watch the ground conditions when fertiliser is applied.

Peter Lawrence, John Pringle and Martina Harrington.

10 steps: reduce your carbon footprint

1 Reduce the age of slaughter: Currently, we slaughter approximately 1.32m prime cattle in Ireland. On average, they are 26 months old and weigh 345kg at slaughter. If we push animal performance and reduce the age at slaughter by even one month, we could reduce the GHG produced by 250kt. That is the equivalent to not having to cull almost 100,000 cows.

For it to be a win-win, farmers need to look at maintaining the slaughter weight by increasing their average daily gains as cheaply as possible.

2 Improve breeding performance: Increase your calves per cow per year. The national average is 0.85 calves per cow per year. This means if I want to sell 25 weanlings per year, I must keep 29 cows. If I can improve my cow fertility and increase my calves per cow per year to 0.95, I only have to keep 26 cows to sell 25 weanlings. A reduction of one cow per 10 calves can cut the beef carbon footprint by 6%.

The win-win is I only have to feed and maintain 26 cows rather than 29 to sell 25 weanlings. Teagasc figures show that by increasing your calf per cow per year from 0.85 to 0.95 you can increase your net margin per cow by €87.

To achieve this performance you need to breed a good fertile cow, which requires a well thought out breeding plan. You must also cull unproductive cows and calve your heifers at two years of age.

3 Improve animal health: If you have animals with a fluke, worm or virus burden they will not deliver optimum performance. Talk to your vet and put in place a dosing programme that control the fluke and worms on your farm while also addressing any viruses.

4 Proper winter housing and nutrition: When we look at performance on farm, it is often the first winter where animals really underperform, increasing the age at slaughter, but also reducing the chance of heifers reaching target-breeding weights to calve at two years old. This can be due to many issues – health, housing environment or nutrition.

- **Housing environment:** When housing animals ensure they have enough lying space, feed space, water and that the ventilation is adequate. Your Teagasc advisor can call and go through this with you.
- **Health:** Talk to your vet and ensure you have a good dosing regime in place for worms, fluke and lice. Check whether your animals need to be vaccinated
- **Nutrition:** Test your silage and then balance your diet accordingly for protein and energy.

5 Longer grazing season: The longer cattle are grazing, the less fibrous forage they are eating, the less slurry they are producing, the less methane they are generating. Also, if cattle are turned out earlier in the spring to graze paddocks, it gives an opportunity, if soil conditions permit, to apply slurry. This reduces the time slurry has to be stored and methane produced.

The win-win is that Teagasc figures show that for every extra day at grass in spring there is a saving of €2 per LU/day.

6 Incorporate clover: N_20 is produced when chemical nitrogen is broken down in the soil by bacteria. If this source of nitrogen is replaced by biological nitrogen produced by white clover, we can significantly reduce N_2O emissions. Research in Teagasc Solohead showed a reduction of between 11 and 26% in the carbon footprint of dairy systems.

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7 Improve soil fertility: If you have optimum soil fertility, you will require less nitrogen to grow the same amount of grass. Optimum soil fertility is when you have a pH of at least 6.3, and a phosphorous and potassium index of two or three depending on your stocking rate.

Research shows that liming acidic soils increases grass production by 1.0t DM/ha. On a drystock farm, this is valued at €105/tonne DM. An application of 5t/ha of ground limestone to correct soil pH represents a cost of €25/ha/year over five years. The return on investment from lime gives €4 to €7 worth extra grass for every €1 invested in lime.

8 Apply fertiliser in the right conditions: The rate of N_20 production increases when fertiliser is applied in conditions that favour microbial activity. So avoid wet soil conditions, applying in heavy rain or when soil temperatures are very high.

9 Change from CAN to protected urea: Protected urea is urea which is treated with an active ingredient called a urease inhibitor. The urease inhibitor can be either a) coated onto the outside of the fertiliser granule or b) incorporated into the urea granule during manufacture.

It has been shown in Teagasc trials to have the same efficiency and yield but to cost less per kg of nitrogen than CAN. However, the big payoff is that published Teagasc trials have shown that protected urea results in 71% lower nitrous oxide emissions than CAN fertiliser.

10 Carbon sequestration: Carbon sequestration occurs when carbon dioxide (CO_2) is absorbed from the atmosphere by plants during photosynthesis. Carbon is then assimilated into its organic form and can either be respired (by plants or microbes) back into the atmosphere or stored more permanently in soil or in woody biomass.

If more carbon is stored than respired, an ecosystem will act as a CO_2 sink. Globally, soils and forests store vast amounts of carbon with agricultural ecosystems such as grasslands, peatlands and woodlands acting as important sinks. If we can increase the amount of carbon we are sequestering we can reduce our carbon footprint.

The Teagasc Signpost Programme

On 18 May, Teagasc launched The Signpost Programme. The primary objective of the programme is to reduce greenhouse gas emissions by up to 15% by 2025 on the Signpost farms and by 2030 for all farms.

This represents an important first step in reducing GHG emissions from Irish agriculture.

While the primary focus of the programme will be on reducing emissions from agriculture, the programme will also highlight practices that can reduce nutrient losses improve water quality, manage and enhance biodiversity, improve profitability and improve social sustainability (both work-life balance and animal welfare).

A network of 100 Signpost farms spread right across the country from all sectors, which will act as demonstration farms for the programme.

These Signpost farmers will be supported to change how they farm, to reduce emissions while at the same time maintaining, or improving profitability.

Track progress

Farmers will have the opportunity to track the progress of their own local Signpost farm and hopefully be inspired to make a change to how they farm to reduce gaseous emissions.

Two of the 20 farmers in the beef programme are Ruairi Cummins and John Pringle.

Ruairi Cummins

Ruairi Cummins farms in Rossenarra Demense in Kilmoganny, Co Kilkenny. Ruairi farms alongside his wife Helen and three children Ciara, Eoin and Laura. Ruairi runs a spring-calving suckler system with bull calves brought through to slaughter at under 16 months and heifers sold as stores at 16 to18 months. Some of the lighter bull calves are castrated at sold as stores at 16 to 18 months also.

"We have really focused on improving breeding efficiency over the last number of years in particular targeting a younger age at first calving," says Ruairi.

Higher age at first calving increases the lifetime emissions burden of the cow. In 2021, all of Ruairi's heifers calved on target at two years of age.

Ruairi is also very focused on increasing animal growth rates and animal performance is closely tracked and monitored through regular weighting of stock on the farm. Achieving higher growth rates leads to a higher final weight at finishing and/or lower finishing age. This means more beef relative to the length of time the animal is on the farm producing emissions.

"I have focused on production over the last number of years. However, with the challenges facing the beef sector into the future I believe I can build on breeding and grass management improvements further in the next few years to enhance the sustainability of my farm from both a profitability and environmental perspective,"concludes Ruairi.

John Pringle

My farm is a typical Co. Wicklow drystock family farm. My wife Linda and I have three children, Lucy and twin boys William and Scott who all have a great interest in the farm and nature. As a newly selected participant for the Teagasc Suckler Signpost Beef Demonstration Farm Programme, I am very conscious of passing on the farm to the next generation in good environmental health.

I operate a traditional mixed farming system which consists of a suckler beef herd and a mid-season ewe lambing flock.

All the farm is in grass and it comprises 58ha all located in the one block. The suckler herd is made up of 44 spring-calving cows calving from mid-February to late April. I operate a closed herd policy and all my replacement heifers are calved at around 24 months.

All males are kept entire and are finished under 16 months at 380kg to 400kg carcase. Heifers which are not kept for breeding are either sold as bulling heifers or finished on the farm at 22 months of age. The mean lambing date for our 255 ewes is around 15 March and all lambs are finished off the farm.

I am determined to showcase that suckler beef and sheep farming can both be profitable but most importantly are environmentally sustainable and work in harmony with nature. I am very keen on looking after the health and biology of my soils, enhancing bio-diversity and looking after the wildlife and habitats on my farm.

John Pringle and his daughter Lucy.