signpost

Manageable steps to lower emissions

Emission reduction goals can be achieved by adopting a combination of feasible changes.

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Advisor Marie Flynn and Jack Kearney inspect a field where slurry has been applied using LESS. \Mark Moore

Two of the three components of environmental sustainability, biodiversity and water quality, are highly 'relatable'. No farmer would object to greater numbers and diversity of birds, plants and insects on their farms, and I've yet to meet one who wouldn't like our waters to be pristine.

The third leg on the sustainability stool, reducing emissions of greenhouse gases such as carbon dioxide or methane, is a harder problem to grasp.

But while you can't see them, or smell them (you might smell methane, a serious greenhouse gas emitting from ruminants, but usually concentrations are so low it is scarcely detectable by the human nose), farmers are facing the challenge of significantly reducing greenhouse gas (GHG) emissions by 2030.

Farmers ask whether this means a cut in their stock numbers. Evidence shows that relatively straightforward management changes can achieve significant reductions on most farms without changes to stock numbers.

Jack Kearney and his father Larry are Glanbia suppliers and a Signpost farm in Rathcormac, Co Cork, farming 82ha. They were milking 138 cows in 2019, with a total of 203 livestock units (LU) on the farm. The overall farm stocking rate was 2.48 cows/ha.

Management changes made on the farm will deliver a 15% to 20% reduction by 2030. These changes have been modelled through the life cycle assessment model for farm emissions.

"In 2019, we had a 25% replacement rate for the dairy herd and meal feeding was 935kg/meal/cow," says Jack.

"Cows produced 6,422kg/milk/cow, or 515kg/milk solids/cow, which was within the top 10% of the milk suppliers within Glanbia for that year.

"We used 255kg/chemical N/ha and 70% of the chemical N was spread as CAN and the remaining 30% was spread as ordinary urea."

Cows were turned out full-time on the 17 March and were housed full-time on 29 October. Jack spread 50% of his slurry with a trailing shoe and the remainder with a splash plate.

When Jack and Larry carried out their sustainability audit with Bord Bia, the carbon footprint came out at 0.96kg/CO_2/kg/FPCM (fat and protein corrected milk). This compares with an average figure nationally of 0.99kg/CO_2/kg/FPCM.

"Our carbon footprint was slightly lower than the average figure for dairy farmers," adds Jack.

"The next step was to look at how

Table 1: Farm characteristics on Jack/Larry Kearney's farm

Stock	Numbers
Dairy cows	138 cows
Total Livestock Units	203 LU
Farm stocking rate	2.48 LU/ha
Milk production	6.422kg/milk/cow
Kg/Milk solids/cow	515kg/milk solids/cow

Clover is an increasing feature in the farm's paddocks. \ Mark Moore

we could reduce CO_2 emissions by between 15% and 20% by 2025 as part of the Signpost programme."

To do this, the farm was put through the carbon life cycle assessment model to examine different mitigations that Jack and Larry could carry out on the farm. The mitigation options looked at were:

- Moving to 100% protected urea for chemical nitrogen.
- A 25% reduction in N fertiliser application rate by incorporating white clover.
- A 150kg reduction in concentrates fed per cow.
- All slurry applied using low emission slurry spreading (LESS) and spring slurry applications.
- Increasing milk solids from 515kg/cow to 540kg/cow.
- Combination of all scenarios.

1 Move to 100% protected urea

This is the mitigation option that has greatest effect on GHG emissions reductions on the farm.

"We were shown how 100% protected urea could reduce the carbon footprint on the farm from 0.96kg CO_2/kg FPCM (Fat and Protein Corrected Milk) to 0.89kg CO_2/kg FPCM," says Jack. This mitigation option can lead to a 7.3% reduction in GHG emissions for the farm.

"By using 100% protected urea, we will need to use straight phosphorus (P) as protected urea products do not contain phosphorus," says Jack.

Some protected urea products do contain potassium (K), but in some cases, straight potassium (K) may need to be used.

Table 2: Nutrient use characteristics on Jack/Larry Kearney's farm.

Fertiliser	Rates
Total chemical N/ha	255kg/N/ha
CAN	70%
Urea	30%
Slurry trailing shoe	50%
Slurry splash plate	50%

2 A 25% reduction in N fertiliser application rate by incorporating white clover

This mitigation option means Jack and Larry reducing chemical nitrogen from 255kg/N/ha back to 190kg/N/ha, or a 65kg/N/ha reduction in chemical nitrogen use.

This mitigation option would result from improved soil fertility in the form of improved lime, phosphorus (P) and potassium (K) status. Or it could result from a reduction in chemical nitrogen due to the use of clover across the farm.

Soil fertility has to be corrected before clover will establish. The soil fertility or clover option will not happen overnight and will take time and planning on any farm. The reduction in fertiliser use of 25% could lead to a 5.2% reduction in GHG emissions for Jack and Larry's farm.

3 A 150kg reduction in concentrates feed per cow

The third possible mitigation action of reducing meal feeding levels by 0.5kg/cow/day over a 300-day lactation period would lead to a reduction in meal feeding of 150kg/cow.

This would happen in conjunction with improved grassland management and grazing top-quality grass throughout the year to keep the cows adequately fed at all times.

This mitigation option could lead to a 1% reduction in GHG emissions for the farm, a small but significant contribution towards the reduction target.

4 All slurry applied using low emission slurry spreading (LESS) and spring slurry applications

"We were already spreading 50% of our slurry with LESS in 2019," says Jack. By completely switching to LESS and spreading all his slurry in the spring, Jack could reduce the carbon footprint from 0.96kg CO_2/Kg FPCM to 0.94kg CO_2/kg FPCM.

If the Kearneys had been spreading all of their slurry by splash plate, then switched to LESS and all spring spreading of slurry, this would have reduced GHG emissions by as much as 4%, the proviso being that chemical nitrogen use would be reduced in line with the more effective use of slurry.

Continued on p30

From p29

5 Increasing milk solids from 515kg/cow to 540kg/cow

Jack and Larry's cows are already in the top 10% in the Glanbia catchment area, but by increasing the milk solids (MS)/cow by 25kg/MS/cow, they could reduce their carbon footprint from 0.96kg CO_2/kg FPCM to 0.94kg CO_2/kg FPCM.

This mitigation option can lead to a 2% reduction in GHG emissions, achieved through a continual improvement in the EBI of the herd. As a result, productivity (MS/cow) increases.

While this mitigation action reduces the carbon footprint per kg of milk, in order to reduce overall or total emissions, cow numbers would need to be reduced slightly (with a lesser number of more productive cows producing the same volume of milk).

In general, for every €10 increase in herd EBI, GHG emissions per cow are reduced by 1%.

6 Combining all scenarios

Some of the mitigation options chosen will have effects on each other. For example, if Jack and Larry reduce chemical nitrogen by 25%, then they will be using less fertiliser and the reduction in GHG emissions from using protected urea will be less than 7.2%. Some other mitigation actions will also affect each other.

When all five scenarios were run through the life cycle assessment model together, they reduced the carbon footprint from 0.96kg CO_2/kg FPCM to 0.81kg CO_2/kg FPCM for the farm. All of the mitigation options together can deliver a 15.6% reduction in GHG emissions for Jack and Larry's farm.

In summary, for Jack and Larry to reduce GHG emissions by 15% by 2025, they will need to implement the following mitigation actions:

- Switch to 100% protected urea.
- Introduce clover swards to reduce chemical nitrogen use.
- Continue to improve grassland management and maintain/reduce concentrates fed.
- Switch to LESS for slurry spreading and spread all slurry by the middle of May.
- Continue to breed better cows using EBI and continue to improve cow productivity.
- Examine other potential improvements on the farm, such as greater energy efficiency, adding forestry where feasible and enhanced management of hedgerows.

Larry Kearney and the herd head home for milking.\ Mark Moore

Figure 1: Kg CO_2 eq/kg FPCM

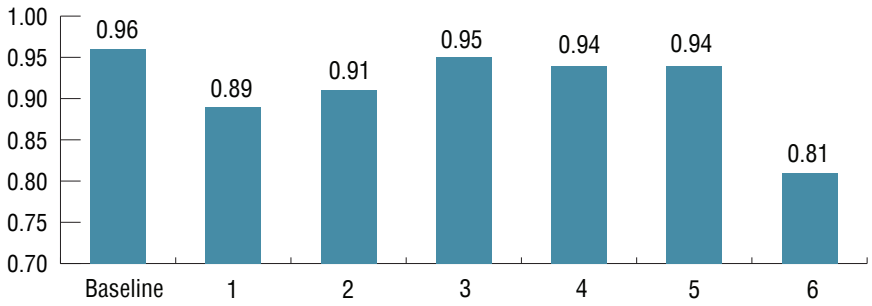

Table 3: Summary of projections for mitigation actions by Jack and Larry Kearney.

Mitigation Action	Percentage reduction in carbon footprint
0% to 100% protected urea	7.3% reduction
Reduction of 25% chemical N	5.2% reduction
150kg/cow reduction in concentrates fed	1.0% reduction
50% to 100% LESS and spring application of slurry	2.0% reduction
5% increase in milk solids/cow	2.0% reduction
Combination of all five scenarios	15.6% reduction

While Table 3 quantifies the percent reduction in carbon footprint for each action, some actions have a crossover effect in the total farm reduction effect.