Case study: what one dairy farmer is doing to reduce total farm emissions

Seamus Kearney and Jonathan Herron
Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork

Summary

- In this case study, the adoption of the main mitigation actions reduced total farm emissions by 13.2% and reduced farm costs by €20,750.
- Reducing reliance on chemical nitrogen and switching to protected urea are priority actions on all farms to reduce emissions.

Introduction

The Agricultural sector has been asked to reduce greenhouse gas (GHG) emissions by 25% by 2030. There is an urgency to undertake mitigation actions on-farm and the priority for all dairy farmers is the adoption of the mitigation technologies in the current Marginal Abatement Cost Curve (MACC) at farm level. A case study was conducted using the Moorepark Dairy Lifecycle Assessment (LCA) model to establish the impact of technology adoption on total farm GHG emissions and the financial impacts of those technologies on a dairy farm. The case study dairy farm was milking 113 cows with a stocking rate of 2.28 LU/ha. Cows were producing 556 kg milk solids (MS) per annum. Replacement rate was 22% and herd EBI was €156. The soil fertility status on the farm is presented in Table 1.

Table 1. *The soil fertility status of the farm*

Lime status	% of farm	P & K status	P%	K%
< 5.9 pH	0%	Index 1	0%	0%
5.9 – 6.2 pH	9%	Index 2	66%	12%
6.2 – 6.5 pH	61%	Index 3	27%	41%
above 6.5 pH (for clover)	30%	Index 4	7%	47%

Results

Using AgNav, a new digital sustainability platform for estimating on-farm emissions, a baseline emissions for the farm was established – "*Know My Number*". The total emissions for the farm was 700 t CO_2-e/annum. In the "*Make My Plan*" stage, an action plan was created for the farm. The priority on the farm was to reduce reliance on chemical nitrogen and switch to protected urea. The agreed actions were:

- Spreading the vast majority of chemical nitrogen as protected urea/low emitting compounds including 18:6:12 and 10:10:20 (95% protected urea)
- Reducing chemical nitrogen use by 80 kg nitrogen/ha by
    - » Improving soil pH to over 6.5 and improving phosphorous and potassium status to Index 3 levels
    - » Spreading all slurry in spring with LESS
    - » Incorporating clover on whole farm
- Producing the same milk output by increasing milk yield by 20 kg MS/cow and reducing cow numbers by 3.5%.
- Reducing replacement rate by 4% (from 22% to 18%)

The impact of the mitigation actions on total farm greenhouse gas emissions are presented in Figure 1. A reduction of 13.2% in total emissions or 92.5 t CO_2-e was calculated for this farm. Switching to protected urea and reducing reliance on chemical N by 37% had the largest impact on GHG emissions, reducing total farm emissions by 9.7%.

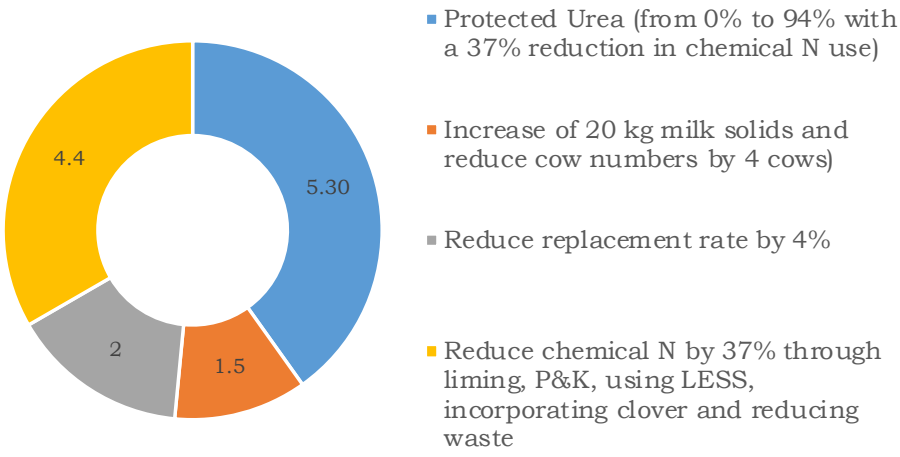

Figure 1. *The impact of mitigation actions on total farm emissions (% reduction in total GHG emissions)*

The implementation of these actions reduced total farm costs by €20,750 with the greatest contribution coming from reducing chemical nitrogen use by 37% but with a corresponding improvement in soil fertility, better use of slurry and incorporating clover into grassland swards.

Table 2. *The impact of mitigation actions on farm costs*

Action	Impact on costs
Switching to protected urea	-€4,520
Reducing chemical nitrogen application by 37%	-€7,840
Increasing milk solids per cow by 20 kg & reducing cow numbers by four	-€4,440
Reduce replacement rate by four percentage points to 18%	-€3,950
Total impact on farm costs	**-€20,750**

Conclusions

There is considerable scope on all dairy farms to reduce emissions while also reducing farm costs. Reducing reliance on chemical nitrogen and switching to protected urea for the nitrogen that is used on the farm is the starting point to reducing greenhouse gas emissions on all farms.