



# Measuring sustainability of agricultural emissions

The **TEAGASC** National Farm Survey 2017 Sustainability Report contains a wealth of information about gaseous emissions on Irish farms, which is crucial in measuring and improving sustainability.

The recently published Teagasc 2017 Sustainability Report outlines the sustainability performance of dairy, drystock and tillage farms through data collected by the Teagasc National Farm Survey. Sustainability reflects the economic and social well-being of those involved in farming, and also encompasses agriculture's interaction with the environment. On the environmental side, agriculture is the largest contributor to greenhouse gas (GHG) emissions of any sector in the Irish economy at just over 33%. Moreover, Ireland's emissions of ammonia come almost exclusively from the agriculture sector. Ireland is a party to international agreements designed to limit emissions, with challenging reduction targets in place for both gases over the next decade. Hence, this article focuses on the gaseous emissions aspect of environmental sustainability, while at the same time acknowledging that stakeholders should be concerned with all three pillars (economic, social and environment) of sustainability.

## Approach to measurement

One of the challenges in both measuring and improving farm sustainability is that every farm is unique. Farms differ in term of size, what they produce, and their production intensity. These factors all influence the level of emissions of GHGs or ammonia from individual farms. Therefore, while reporting the total emissions from individual farms is relevant, greater granularity, focusing on emissions per hectare or emissions per unit of product, provides a more relevant farm assessment. GHGs emitted by dairy, cattle, sheep and tillage farms can be converted to a common currency of CO<sub>2</sub> equivalents (using

Intergovernmental Panel on Climate Change [IPCC] methodology), which allow comparisons to be drawn across these farm types. A three-year rolling average is used to iron out the impact that variable production conditions, or positive and negative price shocks, can have on emissions from one year to the next.

## Results

### GHG emissions

Due to the more intensive nature of production, GHG emissions per hectare from the average dairy farm are two and four times higher than on the average drystock and tillage farms, respectively. Emissions on non-dairy farms have tended to remain static over the period examined, whereas emissions on dairy farms have trended upwards, reflecting the growth in activity that has happened with milk quota removal. However, when GHG emissions are expressed relative to the revenue generation capacity of the farm (layering environmental and economic sustainability together) the narrative changes (**Figure 1**). Due to their superior revenue-generating capacity and consequent economic sustainability, on average dairy farms produce close to half of the GHG emissions per Euro of output generated compared to cattle farms. Similarly dairy farms generate only about two-thirds of the emissions per Euro of output compared to sheep farms. However, as noted in the detailed report (Buckley *et al.*, 2019), on the basis of kg of product produced (milk, liveweight beef and sheep) the carbon footprint of production has been declining over the study period across all farm types.

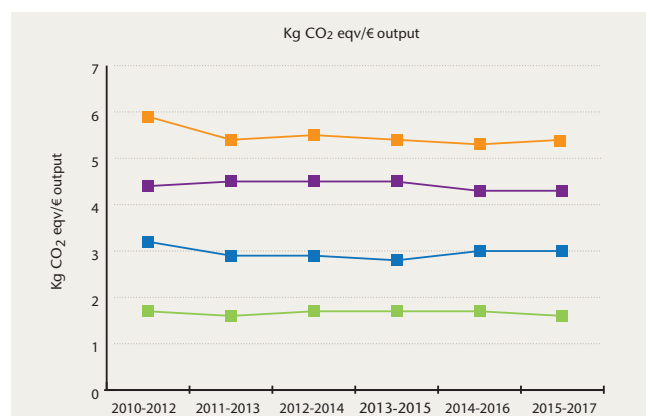
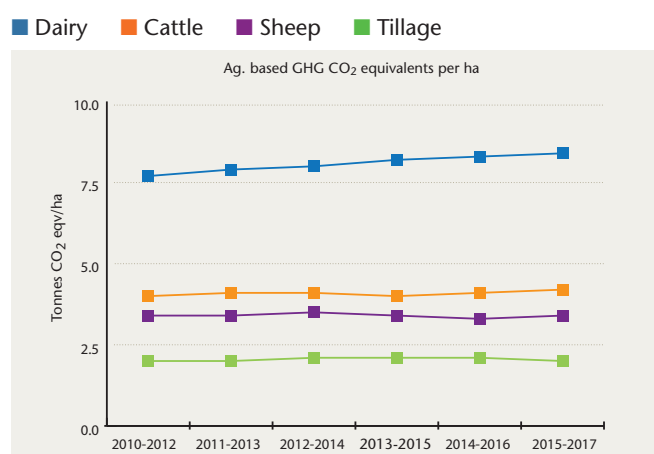


FIGURE 1: Comparison of GHG emissions based on CO<sub>2</sub> equivalent per hectare, and on CO<sub>2</sub> equivalent per Euro output.

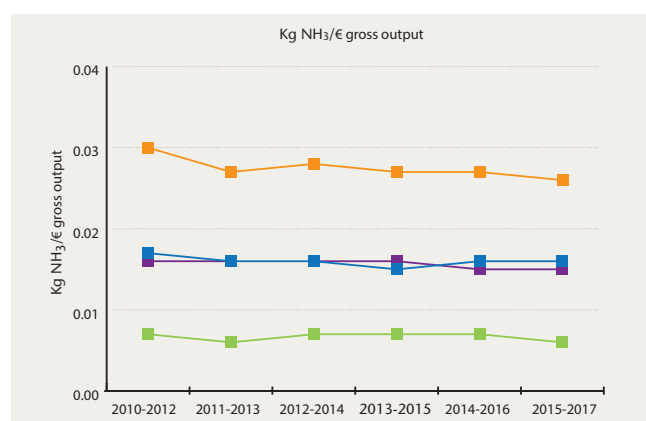
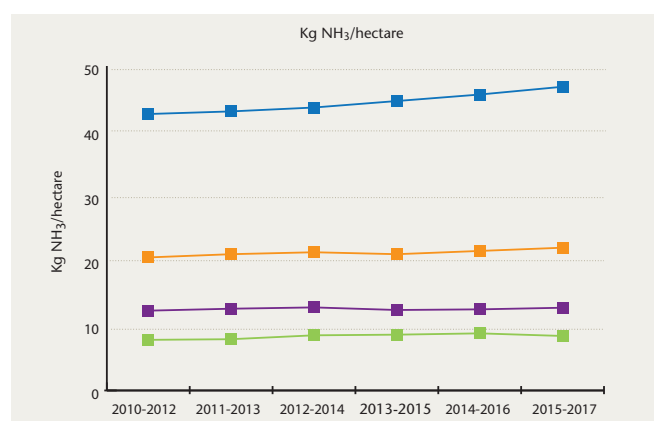


FIGURE 2: Comparison of ammonia emissions based on NH<sub>3</sub> equivalent per hectare, and on NH<sub>3</sub> equivalent per Euro gross output.

### Ammonia

As with GHG emissions, dairy farms have the highest level of ammonia emissions on a per hectare basis. Per-hectare dairy farm ammonia emissions are on average two, 3.5 and five times higher than the average emissions on cattle, sheep and tillage farms, respectively. Non-dairy farm ammonia emissions have again remained relatively static on a per hectare basis over the study period, whereas ammonia emissions on dairy farms have been trending upwards since EU milk quota abolition. However, when ammonia emissions are expressed relative to the associated revenue generated on farms, a somewhat different picture emerges. Cattle farms are the highest emitters of NH<sub>3</sub> per Euro of gross output generated, 1.8 times higher than dairy and sheep farms, and four times higher than tillage farms (Figure 2). However, it again should be noted that on a kg of product produced basis (milk, liveweight beef and sheep) the ammonia footprint of production has been declining over the study period.

Overall, the sustainability report illustrates that an incremental improvement in GHG and ammonia emission intensity in recent years has been achieved on Irish farms, and there is a trade-off between economic and environmental sustainability. However, the sector needs to make significant progress in emissions mitigation if internationally agreed absolute emissions reduction targets are to be achieved.

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### Reference

Buckley, C., Donnellan, T., Dillon, E., Hanrahan, K., Moran, B. and Ryan, M. (2019). 'Teagasc National Farm Survey 2017 Sustainability Report'. Available at: <https://www.teagasc.ie/media/website/publications/2019/2017-sustainability-report-250319.pdf>.

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