Dairy-4-Future – Ammonia Emissions on Local Pilot Farms

Dairy-4-Future is an exciting €3.8 million Atlantic Interreg funded project, which aims to improve the sustainability of dairy farming in the Atlantic region of Europe. Through a consortium of eleven partners, from Scotland to the Azores, the Dairy-4-Future project aims to increase the competitiveness, sustainability and resilience of dairy farms in these Atlantic regions, through the development of innovative and efficient dairy systems.

At the heart of the project are a group of 100 Pilot Farmers and 10 Experimental/Demonstration Farms drawn from all the regions involved. 10 of these are local farms here in N. Ireland with CAFRE being the local demonstration farm. Detailed data on economic, environment and social sustainability aspects of dairy farming have been collected and are currently being analysed. Ammonia emissions data from the first year of the project have now been released.

What is ammonia?
Ammonia is an air pollutant and when it reacts with other atmospheric pollutants, it can impact negatively on human health. Ammonia is not a greenhouse gas, but can indirectly result in increased emissions of nitrous oxide which is a potent greenhouse gas. Deposition of ammonia on land can damage sensitive plant species in protected habitats. Ammonia is one of the key environmental challenges facing N. Ireland agriculture at present.

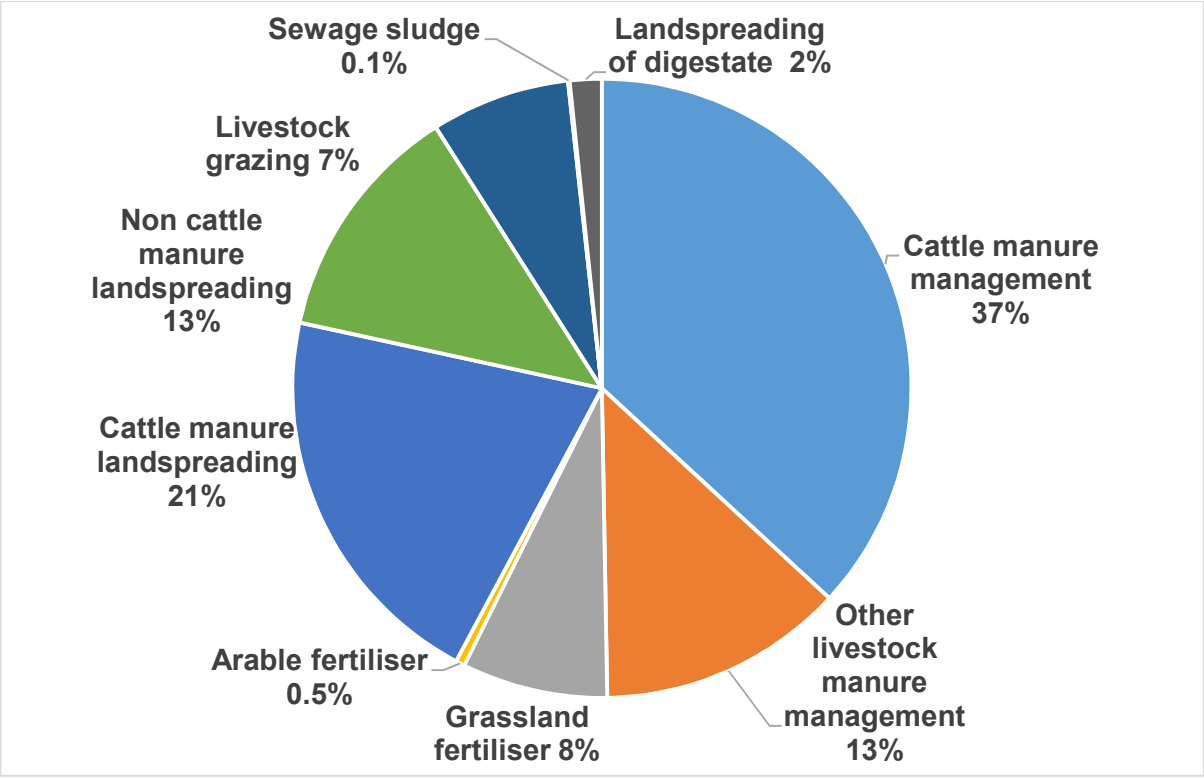

Figure 1. N. Ireland agricultural ammonia emission (2018) by management category

According to the report: Making Ammonia Visible, An Annex to *"Delivering our Future, Valuing our Soils: A Sustainable Agricultural Land Management Strategy for Northern Ireland"*, 2017, the main source of ammonia emissions in N. Ireland comes from manure and slurry spreading, which accounts for 34% of emissions, followed by livestock housing, accounting for 28% of ammonia emissions as indicated in Figure 1. The majority of the ammonia emissions (over 70%) come from cattle livestock farming according the same source as indicated in Figure 2. This data is produced by models using agricultural activity data and the model data is backed up by a network of monitoring stations across N. Ireland.

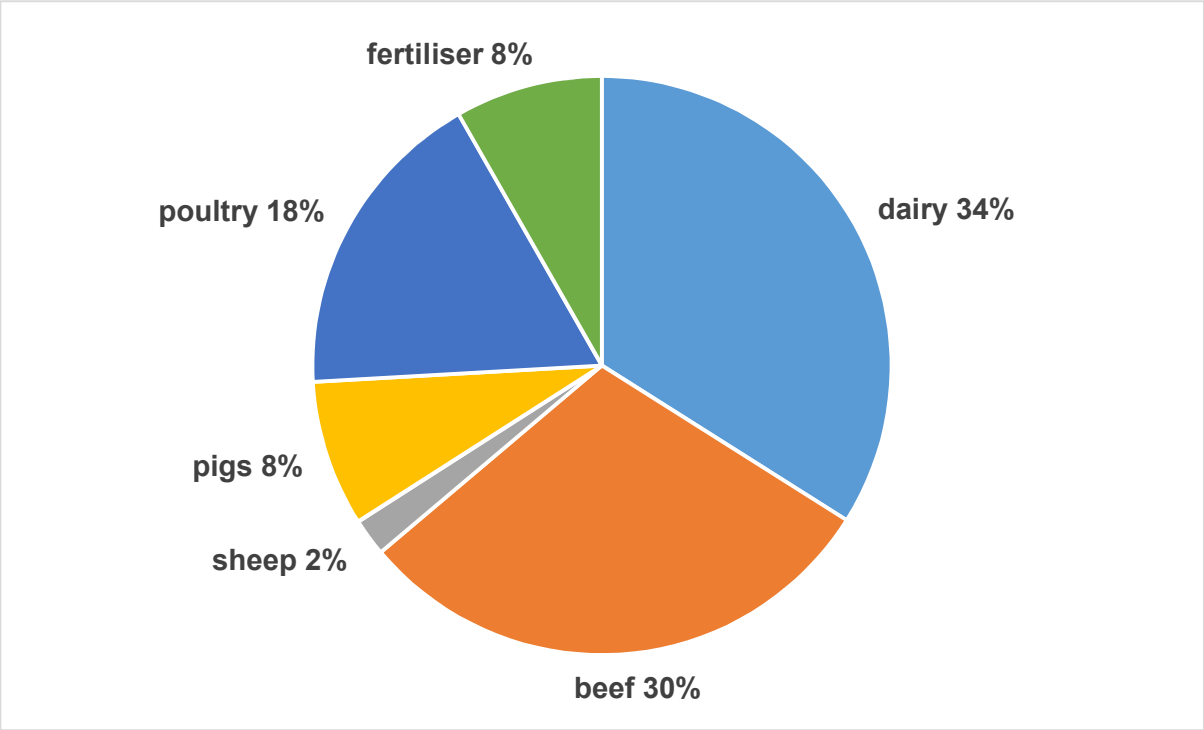

Figure 2. N. Ireland agricultural ammonia emissions (2018) by livestock and fertiliser category

Local Dairy-4-Future Pilot Farms - Ammonia Emissions

As part of the work of the Dairy-4-Future project, ammonia emissions on the 10 local Pilot Farms are being calculated from detailed farm management data. The data has been analysed by Teagasc, Moorepark, the project environmental analysis work package leader. Ammonia emissions calculated from detailed farm management data have been expressed per 1,000 kg of fat and protein corrected milk yield (FPCM). The ammonia emissions analysis results are presented in Table 1 below. These results have been fed back to the participating farmers to indicate the source of the emissions, and how they may be reduced.

Table 1. N. Ireland Dairy-4-Future Pilot Farms Ammonia Emissions (NH_3/1,000 kg FPCM)

Dairy Farm Ammonia Emission Source	NI Dairy-4-Future Project Farms Average	Emissions (%)	Range
Housing	2.31	44.7%	1.86 to 3.25
Manure storage	0.54	10.4%	0.27 to 1.09
Manure application	1.62	31.4%	1.13 to 2.33
Fertiliser application	0.43	8.4%	0.03 to 3.00
Grazing / outdoor	0.27	5.2%	0.6 to 0.53
Total Ammonia Emissions	**5.17**	**100%**	**4.06 to 6.75**

Nitrogen excretion

One way to reduce the quantity of ammonia available to be released is to lower the crude protein content of the dairy cow diet. Reducing the dietary crude protein in a balanced manner, taking professional nutritional advice on how to do so, will reduce the nitrogen excreted by the cows in their urine which will reduce the quantity of nitrogen in urine and dung that is available be emitted as ammonia.

Protein sources, predominantly soyabean and rapeseed, are amongst the most expensive ingredients in dairy cow concentrates. Reducing the crude protein in the dairy cow diet can

therefore also reduce the cost of concentrate rations. Where modern nutritional analysis software is used to reduce dietary crude protein in a balanced manner, milk production levels will be maintained or increased and anecdotal evidence suggests that in some herds milk protein levels can also increase. DAERA has commissioned a new research programme at AFBI to determine how dietary crude protein can be reduced.

Table 2. N. Ireland Dairy-4-Future Pilot Farms Nitrogen excretion (kg /1,000 kg FPCM)

Dairy Farm Ammonia Emission Source	**NI Dairy-4-Future Project Farms (mean)**	**Range**
Nitrogen excretion	16.2	13.2 to 18.5

Data from analysis of Dairy-4-Future project farms indicates that the lowest levels of nitrogen excretion were fully housed herds (e.g. Farms 4 and 7, Figure 2). The lower levels of nitrogen excretion can be explained by the cows not grazing high crude protein grass and also by the use of professional nutritional advice to balance dietary crude protein and minimise the cost of dairy cow concentrates.

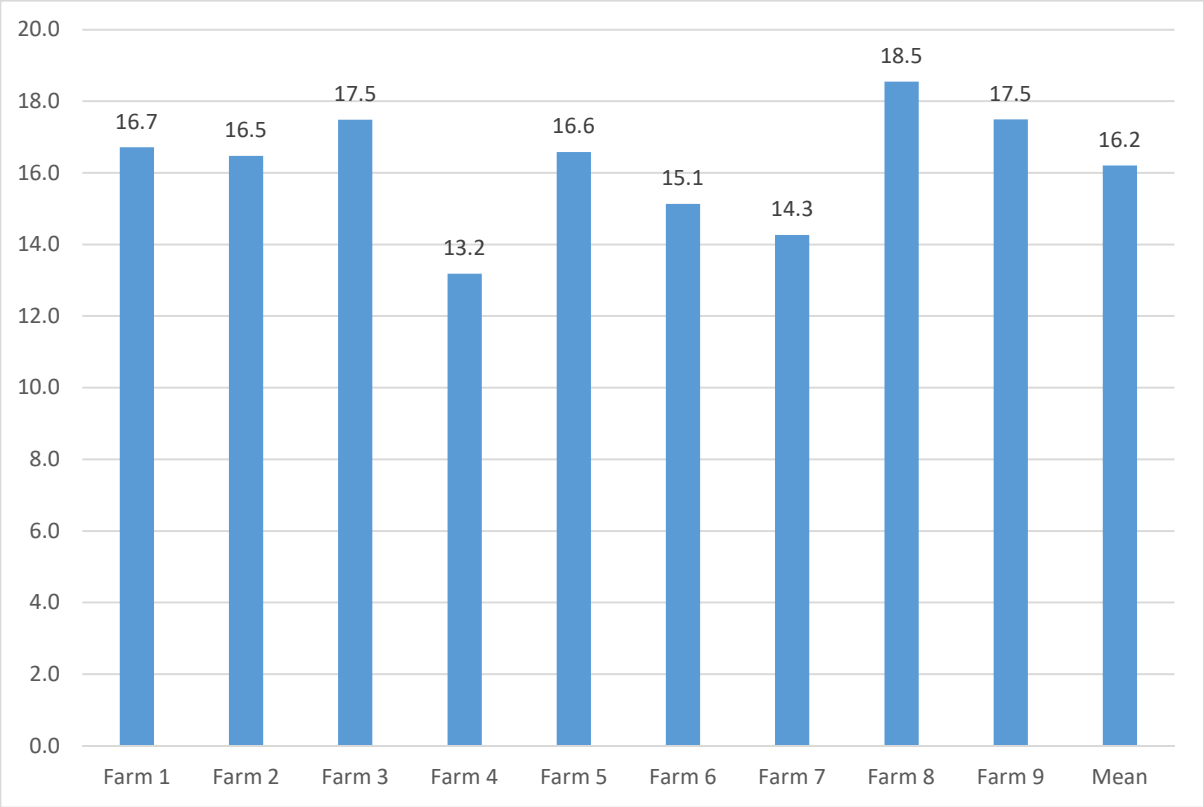

Figure 2. Nitrogen excretion rates per 1,000 kg FPCM on N. Ireland Dairy-4-Future Farms

Emissions from housing

While the fully housed herd tended to have the lowest nitrogen excretion rates, they also had the highest ammonia emissions from housing due to the longer housing period.

Emissions from slurry storage

The highest ammonia emissions from slurry storage was found on a winter housed, summer grazing farm where a proportion of the slurry storage capacity included an uncovered above ground slurry store.

Slurry spreading emissions

The fully housed farms also tended to have higher emissions from manure spreading, due to the greater quantity of manure to be spread although this was mitigated to some extent by the partial use of low emission slurry spreading equipment (LESSE).

Emissions from inorganic fertiliser application

The emissions from inorganic fertiliser application averaged 8% of the total, in line with the N. Ireland ammonia inventory average. However, on one farm which makes excellent use of grazed grass and practices extended grazing, a high proportion of the fertiliser used was unprotected urea. On this farm the total ammonia emission rate was the highest of all the farms with the fertiliser emissions accounting for 44% of total farm ammonia emissions.

Summary

The analysis of ammonia emission data from the local farms involved in the Dairy-4-Future project has highlighted some key messages on where and how to reduce ammonia emissions according to the management system on the farm. Depending on the farm management practices, there is the opportunity to reduce ammonia emissions through: reducing dietary crude protein, applying slurry using LESSE, covering above ground slurry stores, increasing the length of the grazing season and using protected urea or calcium ammonium nitrate fertiliser.