

Leading the way in emissions reduction technology adoption on Signpost cattle farms

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Summary

- The Signpost cattle farmers have adopted many of the climate mitigation technologies recommended by Teagasc, but there still exists scope to further reduce greenhouse gas (GHG) and ammonia emissions on these farms.
- Signpost cattle farmers have a lower carbon footprint per kg live weight produced than reported for the average Irish cattle farmer, showing what is possible for all farmers.
- The Signpost Programme has identified 12 steps to reducing gaseous emissions on cattle farms. These steps include actions to reduce reliance on chemical nitrogen fertiliser use, switching to protected urea, reducing age-at-slaughter and improving animal breeding performance.
- It is advised that all cattle farmers check their position regarding each of the recommended actions. A worksheet is available to help identify possible actions to reduce on-farm GHG emissions at:

<https://www.teagasc.ie/media/website/environment/climate-change/signpost-programme/Looking-After-the-Environment-on-Your-Farm---Beef-Worksheet.pdf>



Background

The Signpost Programme is designed to support and enable cattle farmers to farm more sustainably. This paper aims to benchmark the uptake of recommended climate mitigation practices for the cattle farmers participating in the programme and describe changes over the first two years, (i.e. 2021 and 2022). These results include the metrics for 19 suckler farms participating in the Future Beef Programme, and 12 dairy-beef farmers participating in the DairyBeef 500 Programme.

Results

Family farm income on the Signpost cattle farms in 2022 was €605 per hectare (ha), or 11% higher than the previous year. Compared to the 'average' cattle farmer in Ireland (National Farm Survey, 2022), family farm income on the Signpost cattle farms was over 70% higher. Signpost cattle farmers are making significant progress in the adoption of

key technologies to reduce emissions. Progress on the steps to emissions reduction on the Signpost farms is presented in Table 1.

- Reducing reliance on chemical nitrogen (N) fertiliser use is one of the key technologies available to reduce emissions. This is achieved by:
 - Optimising soil fertility: On Signpost cattle farms, 26% of all soils are optimum for pH, phosphorus (P) and potassium (K). This compares with a national average of 13%.
 - Applying lime to correct low soil pH, which will release N from the soil: the Signpost Farms were extensively soil sampled in late 2021 and early 2022. The farmers have used the results to target lime applications during 2022 – on average, 42 tonnes of lime was spread per farm, equivalent to 0.75 tonnes per hectare farmed.
 - Better use of slurry: The adoption of low emission slurry spreading (LESS) on Signpost farms has doubled between 2021 and 2022 - over three-quarters of the slurry applied in 2022 was by LESS.
 - Using clover: Forty percent of the Signpost cattle farms clover-scored their farms in 2022 - 82% of the grassland area assessed had some clover in it.

Table 1: Performance of Signpost cattle farms in 2022 compared to 2021

	2021	2022	Target
Family Farm Income (€/ha)	543	605	
Reducing chemical nitrogen (N) reliance			
Soil samples with optimum fertility (%)	-	26	90
Lime usage (tonnes/farm)	28	41	Soil pH 6.2+
Slurry spread using LESS (%)	38.5	77.2	100
Grassland with some clover* (%)	-	82	100
Chemical N fertiliser application (kg/ha)	115	98	86
Total chemical N as protected urea (%)	19.7	38.6	>85
Production efficiency			
Days at grass	238	237	250
Replacement Index (€)	106	112	111
Calves per cow per year	0.93	0.91	0.95
Heifers calved between 22-26 months (%)	59.4	62.6	100
Beef output			
Suckler beef output (kg/LU)	355	359	NA
Dairy-beef output (kg/LU)	577	570	NA
Suckler beef output (kg/ha)	660	697	NA
Dairy-beef output (kg/ha)	1368	1455	NA
Age at slaughter (months)			
Bulls	16	16	16
Heifers	23	22	22
Steers	24	24	24
Physical changes			
Hectares farmed	53.4	55.8	NA
Livestock units farmed	99.3	101.1	NA

*40% of cattle farms were clover-scored

- Signpost farmers have started to reduce their dependence on chemical N fertiliser use - application rate was 15% lower in 2022 compared to 2021. The quantity of protected urea used doubled, despite the fact that product supply and availability was an issue.
- Signpost cattle farms have a relatively long grazing season, with stock at grass for 237 days in 2022.
- Replacement Index for suckler cows increased by €6 in 2022 - the target is an increase of €5 per year.
- Almost 63% of the heifers calved at 22-26 months in 2022, up from 59% in 2021.
- Slaughter age of heifers on Signpost farms decreased by one month, with no change for the bulls and steers, which were already very good.

The building blocks of improved animal breeding, grassland management and herd health management are all being implemented to allow further progress in this area.

Gaseous emissions on Signpost cattle farms

Total GHG emissions, GHG emissions per ha and ammonia emissions for the Signpost cattle farms are presented in Figure 1. Total GHG emissions for these farms is 370 tonnes CO₂-equivalents (CO₂-eq) per farm, equivalent to an emissions per ha of 6.75 tonnes CO₂-eq. The national average for cattle farms is 4.4 tonnes CO₂-eq per ha, which have a comparatively lower stocking rate. The carbon footprint for the Signpost cattle farms is 8.5 kg CO₂-eq per kg live weight produced (Figure 2). This is 10% lower than the carbon footprint of beef production on the average cattle farm in Ireland.

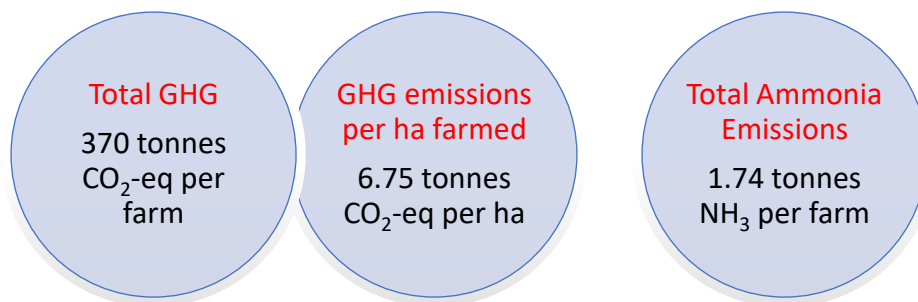


Figure 1. Greenhouse gas (GHG) and ammonia emissions for cattle Signpost farms in 2022

The key drivers of emissions on the Signpost cattle farms are illustrated in Figure 2. Key findings include:

1. There was a change in the total quantity of chemical N applied in the ‘composition’ of fertilisers used (Table 2). In 2021, 65% of the chemical N was applied as calcium ammonium nitrate (CAN) and associated compounds, with this reducing to 40% in 2022. A reduction in CAN and compound use contributes to a reduction in GHG emissions. The quantity of straight urea used in 2022 increased by 6 percentage units compared to 2021. Although this increase has no impact on GHG emissions, it does increase ammonia emissions. The quantity of protected urea almost doubled between 2021 and 2022, corresponding to 39% of total chemical N applied in 2022. An increase in protected urea is positive in terms of reducing both GHG and ammonia

emissions. The combination of reducing chemical N use by 15% and doubling the use of protected urea has led to a 2.2% reduction in total gaseous emissions on the Signpost cattle farms.

Table 2. The percentage of chemical nitrogen (N) fertilisers used on Signpost cattle farms in 2021 and 2022

	2021	2022
CAN and other compounds	65	40
Urea	15	21
Protected urea	20	39

- Average lime usage increased from 28 to 41 tonnes per farm between 2021 and 2022, resulting in a 1.6% increase in farm GHG emissions. The application of lime is recommended despite this initial GHG 'cost', as optimum soil pH will ultimately permit lower fertiliser N application rates and increased N and P use efficiency.
- There was a slight increase in livestock numbers on the Signpost cattle farms in 2022, leading to increased GHG emissions of 1.5%. In a number of cases, this was due to an increase in farm size, and in one case was due to a herd health issue preventing the sale of animals.

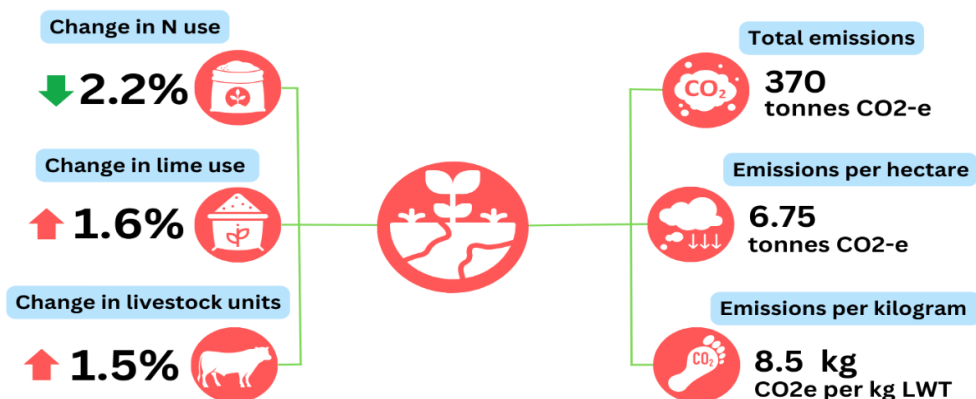


Figure 2. Drivers of greenhouse gas (GHG) emission reduction on Signpost cattle farms in 2022

Conclusion

Considerable progress has been made on the Signpost cattle farms to implement the technologies to reducing GHG and ammonia emissions. There is more potential to reduce total GHG emissions on the Signpost farms. This can be achieved by further reducing chemical N use, and increasing the proportion of chemical N applied as protected urea. Other areas for improvement include reducing age-at-slaughter and age at first-calving. The Signpost farms show what is possible in terms of the use of climate mitigation technologies, and Teagasc believes that they can point the way forward for all farmers. The primary focus for the Signpost Programme, is improving the pace and scale of adoption of climate mitigation technologies, both on Signpost and all cattle farms.