Teagasc National Farm Survey 2021 Sustainability Report

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Rural Economy and Development Programme

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Teagasc
Agriculture and Food Development Authority

Overview

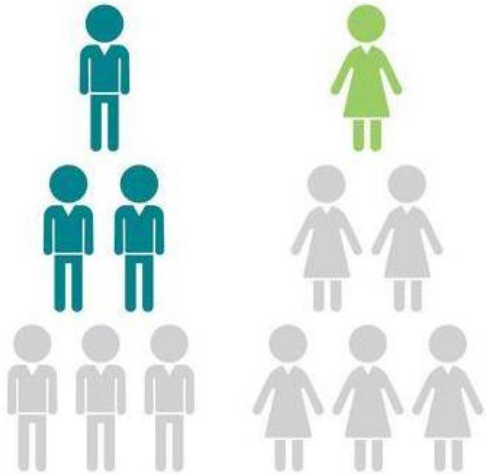
- Conceptual framework
- Methodology
- Results
- Summary / conclusion

Sustainability Framework

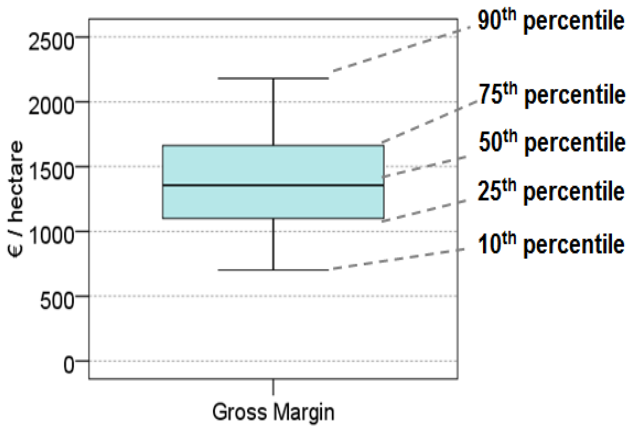
- Farm level sustainability is intersection of:
  1. Economic
  2. Environmental
  3. Social
  4. Innovation

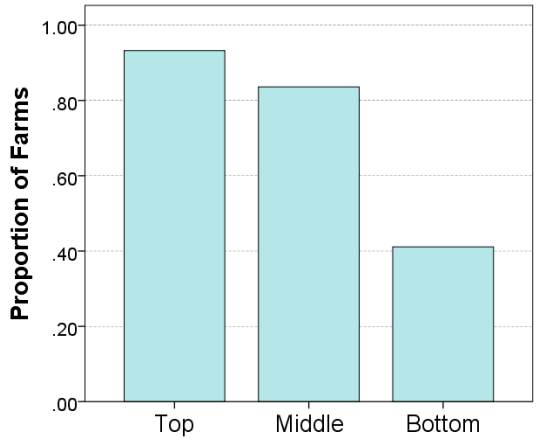
Profile of Teagasc NFS Sample - 2021

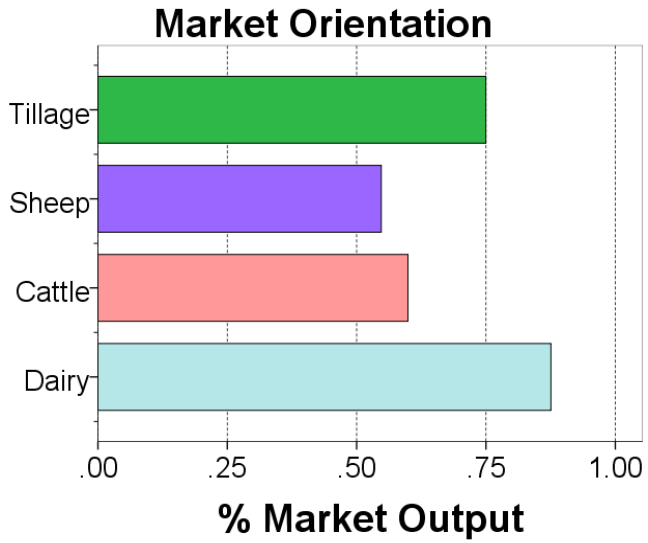
Farm Type	Dairy	Cattle	Sheep	Tillage	All Farms
Sample No.	288	357	111	65	821
Population Represented	15,319	48,227	13,979	6,246	83,771
Average					
Utilisable Agricultural Area (ha^{-1})	64.2	34.7	44.6	67.9	44.2
Grassland Area (ha^{-1})	62.5	34.1	43.6	23.6	40.1
Tillage Area (ha^{-1})	1.7	0.6	1.0	44.3	4.1
Dairy Cow Livestock Units	90.8	0.0	0.0	0.0	16.6
Cattle Livestock Units	40.3	41.4	20.6	28.8	37.0
Sheep Livestock Units	0.5	1.7	34.5	5.9	7.3
Total Livestock Units	133.5	43.4	55.6	35.0	61.3
Farm Stocking Rate (LU ha^{-1})	2.1	1.3	1.4	1.2	1.5

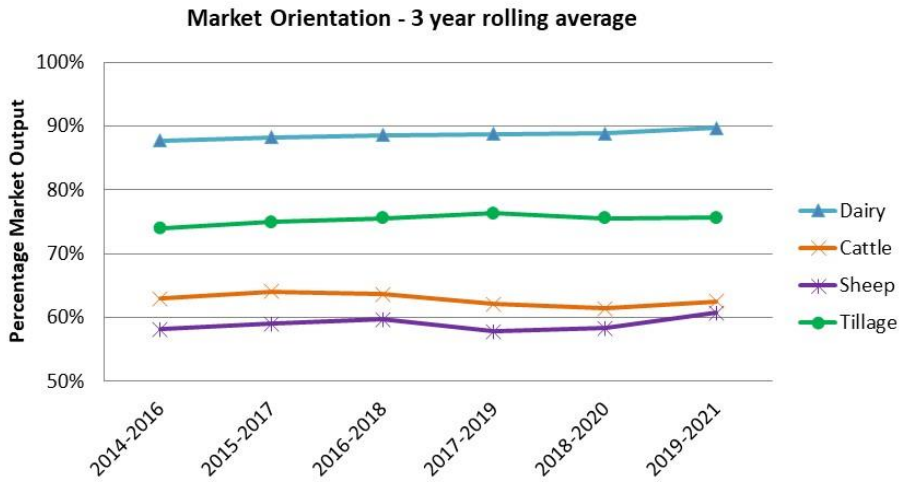


Presentation of Results - Charts







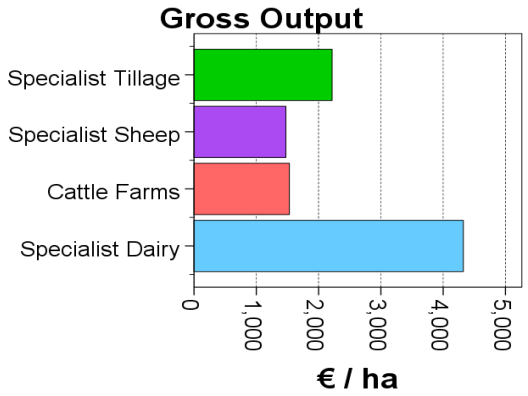


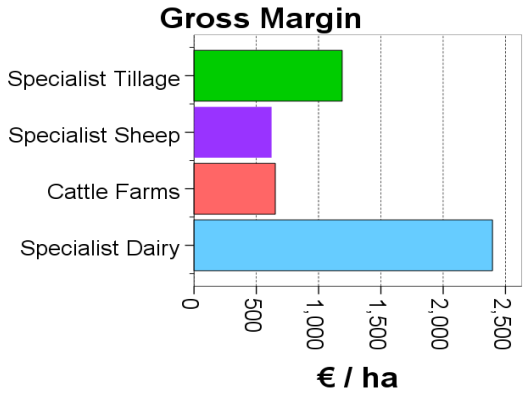
Economic Sustainability

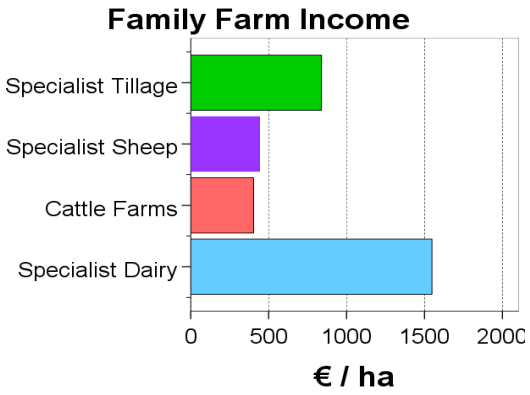
Indicator	Measure	Unit
1. Economic return to land	Gross output per hectare	€ / hectare
2. Profitability of land	Gross margin per hectare	€ / hectare
3. Family Farm Income	Returns to farm family labour, land and capital	€ / hectare
4. Productivity of labour	Family Farm Income per unpaid labour unit	€ / unpaid labour unit
5. Market Orientation	Output derived from market rather than subsidies	%
6. Economic Viability	Economic viability of farm business – Minimum wage for labour & 5% return on non-land based assets	1=viable 0=not viable

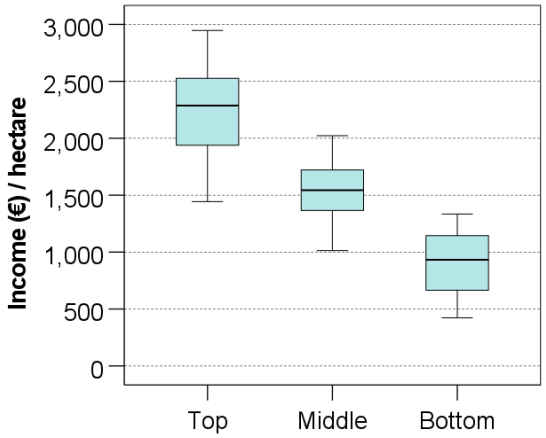
Economic Sustainability

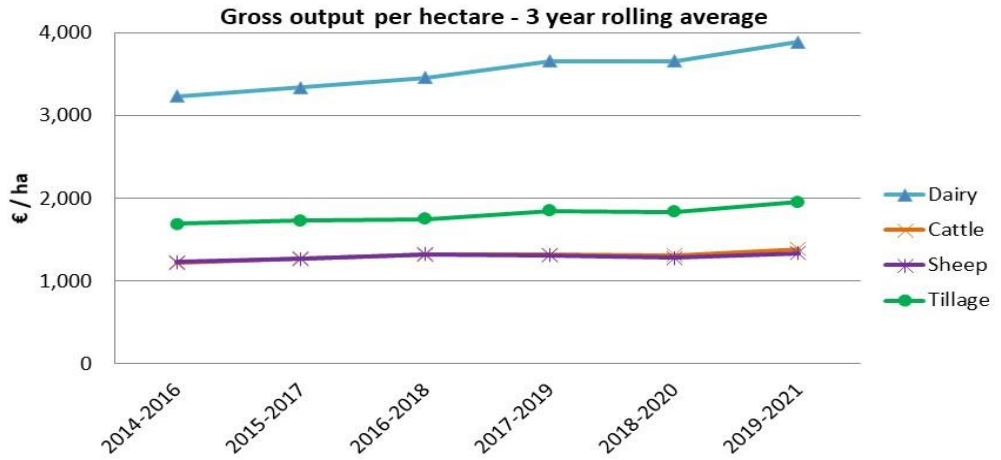
2021 Results

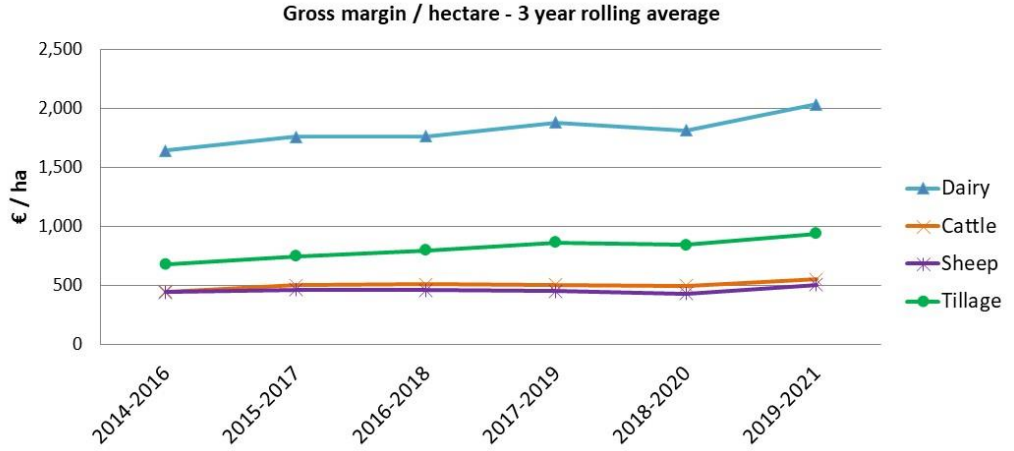


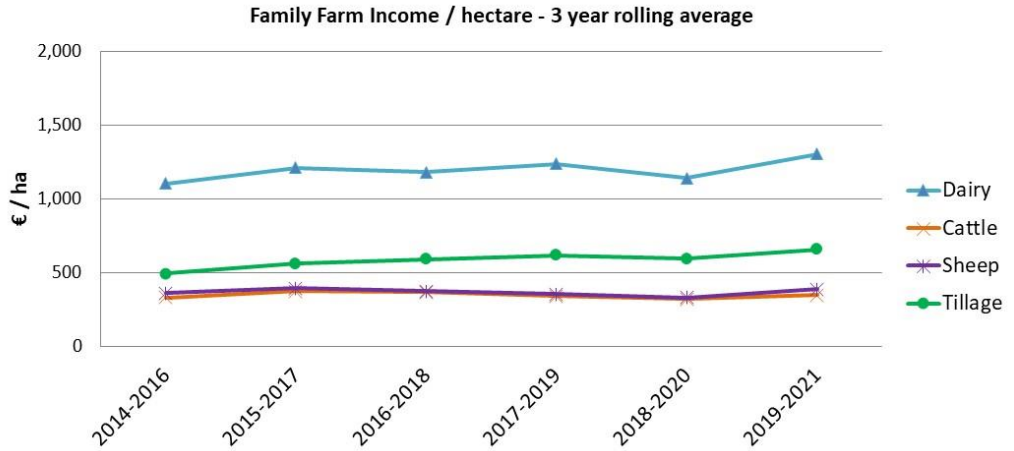






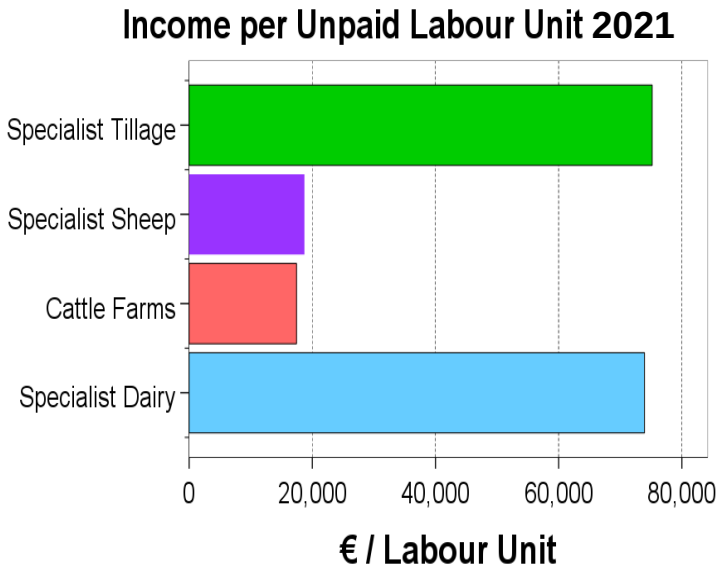


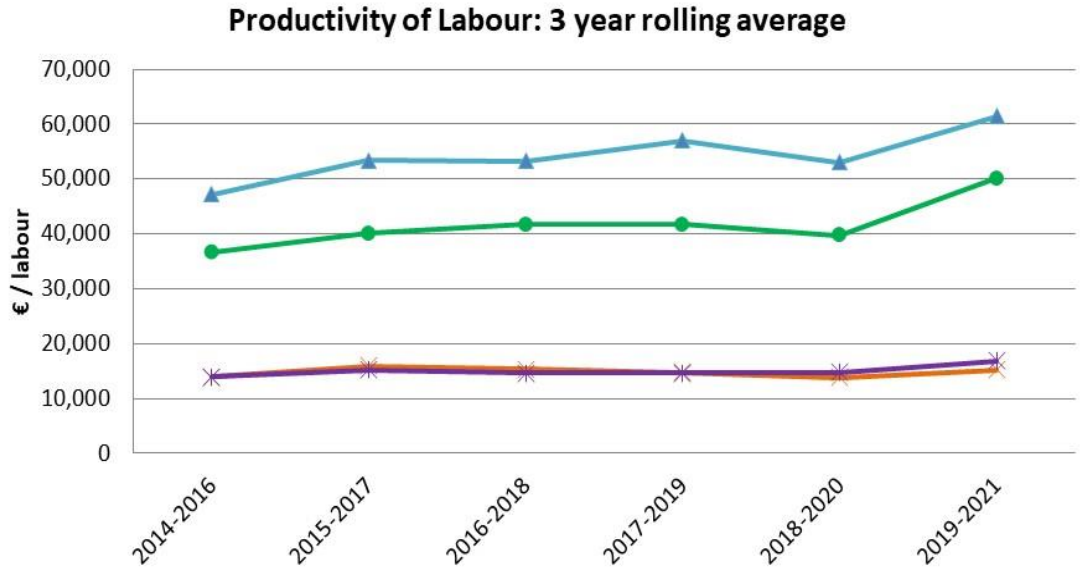


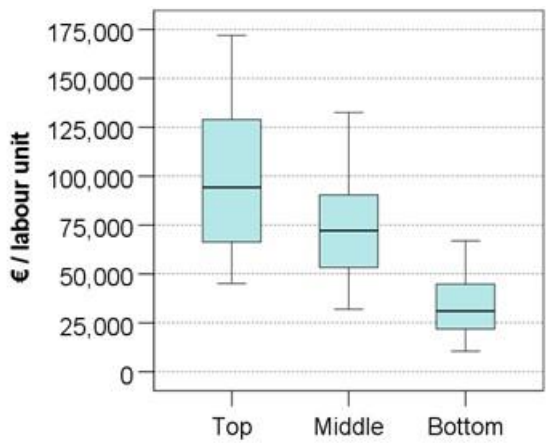


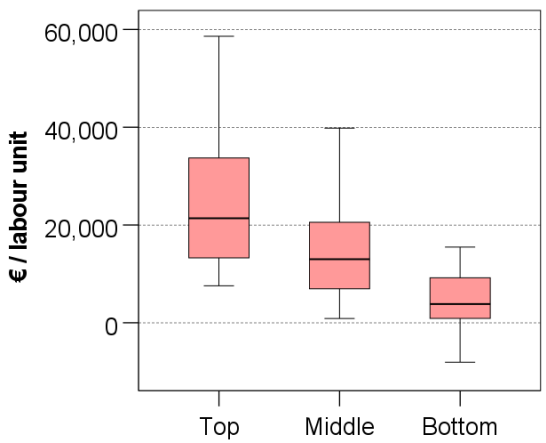
Economic Sustainability

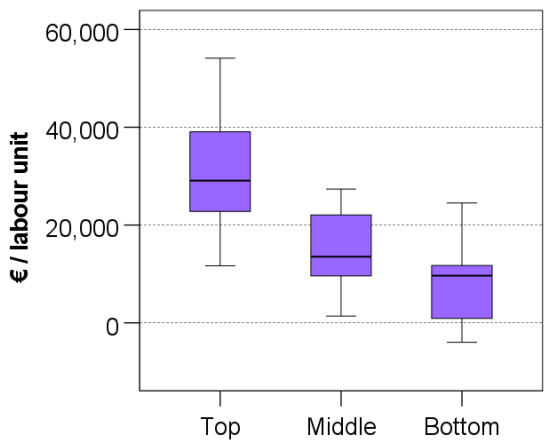
Indicator	Measure	Unit
Productivity of Labour	Family Farm Income per unpaid labour unit	€ / unpaid labour unit

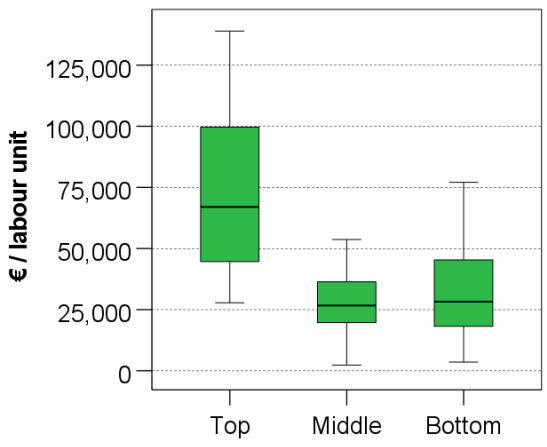






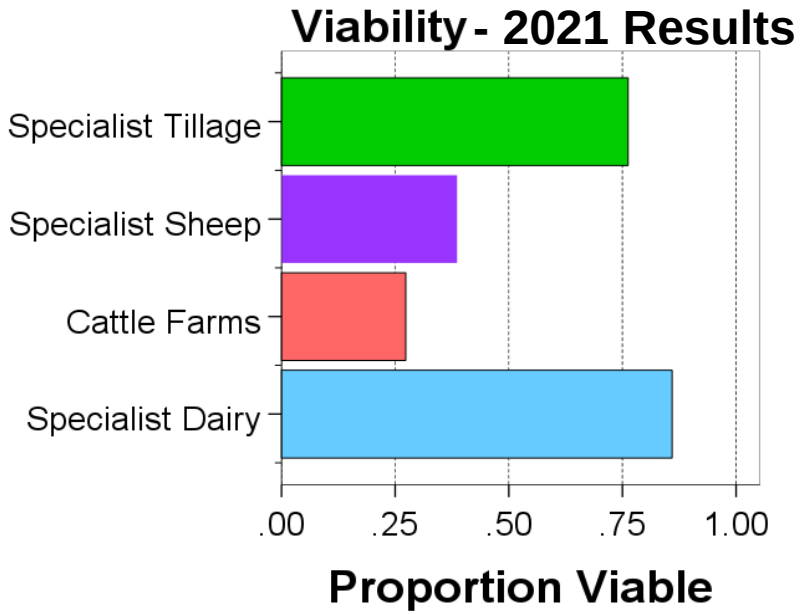


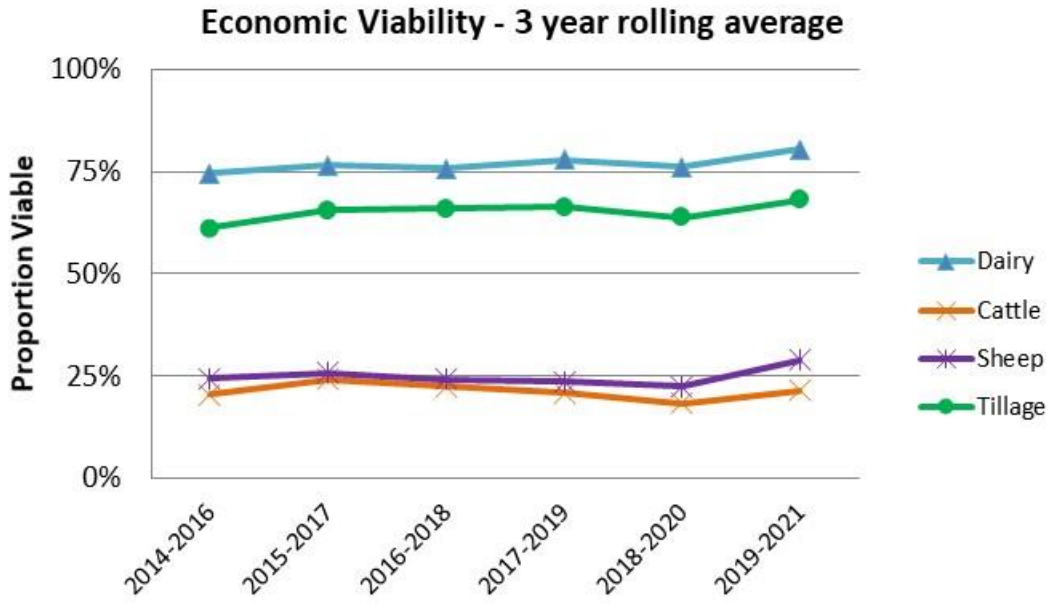




Economic Sustainability

Indicator	Measure	Unit
Economic Viability	Economic viability of farm business – Min wage for unpaid labour & 5% return on non-land based assets	1=viable 0=not viable



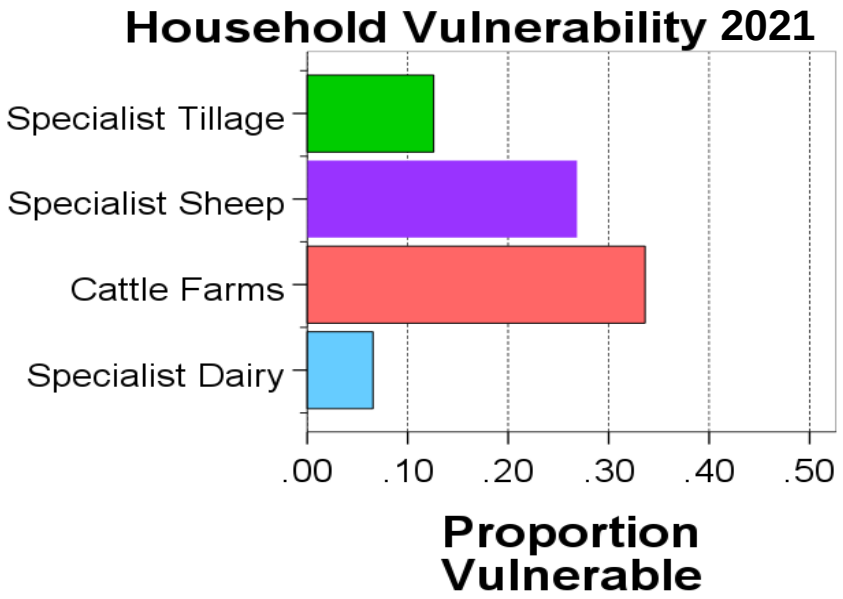


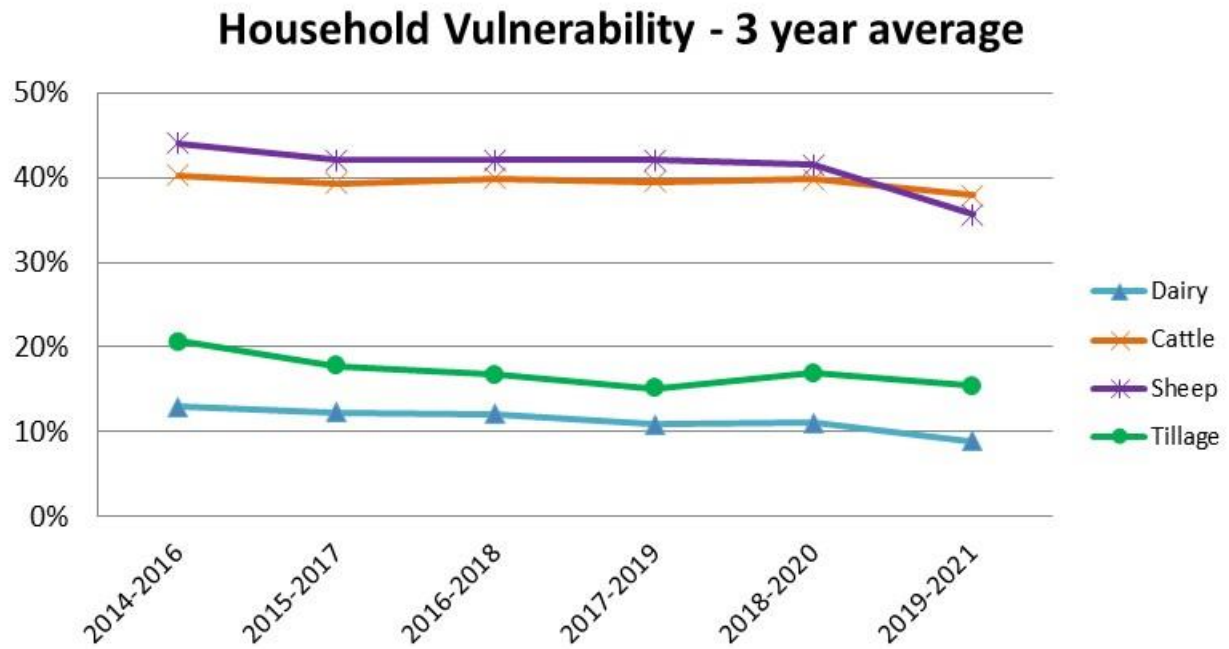
Social Sustainability

Indicator	Measure	Unit
1. Household vulnerability	Farm business is not viable and no off-farm employment	Binary variable, 1= vulnerable
2. Isolation Risk	Farmer lives alone	Binary variable 1=isolated
3. High Age Profile	Farmer is over 60 years old & no members of household under 45	Binary variable 1=high age
4. Agricultural education	Formal agricultural training received	Binary variable 1= agricultural training received
5. Hours worked on the farm	Work load on farm** (Off-farm work hours not included)	Hours worked on the farm
6. Total hours worked	Work-life balance	Hours worked on and off farm

Social Sustainability

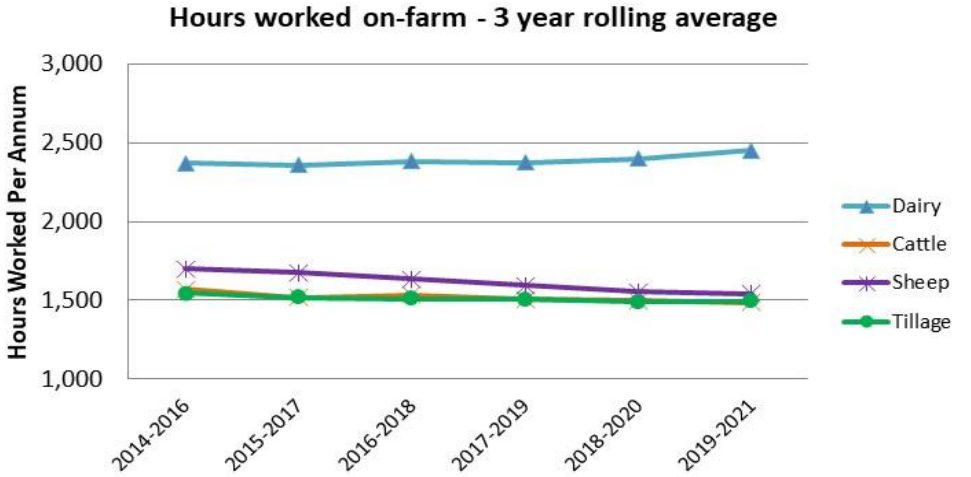
Indicator	Measure	Unit
Household vulnerability	Farm business is not viable & no off-farm employment	Binary variable 1= vulnerable 0=Non vulnerable

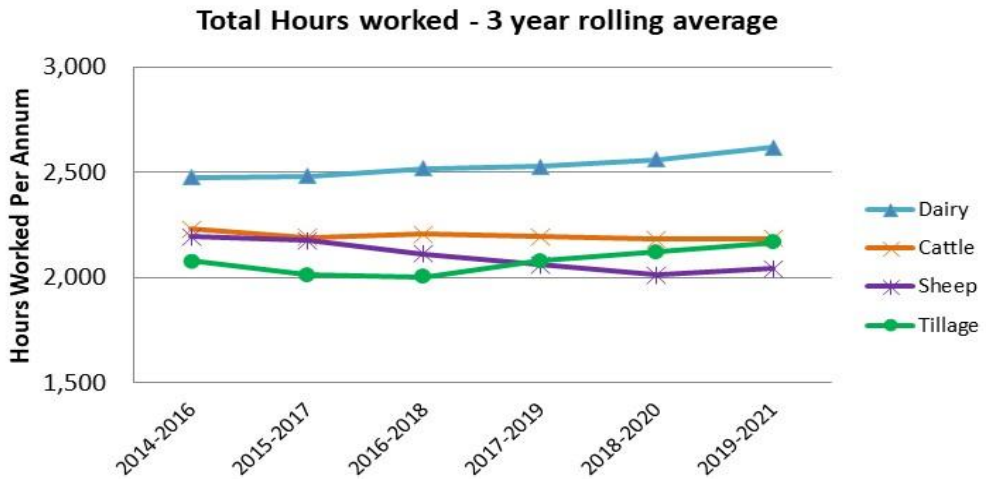




Social Sustainability

Indicator	Measure	Unit
Hours worked on farm	Work load on farm (Off-farm work hours not included)	Hours worked on the farm
Total hours worked	Total work load (On and off-farm)	Hours worked on and off farm

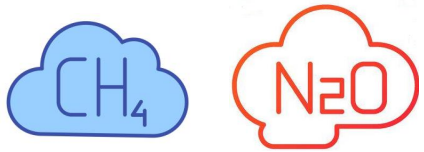


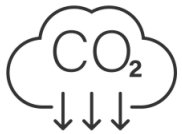


Environmental Sustainability

1. Gaseous Emissions

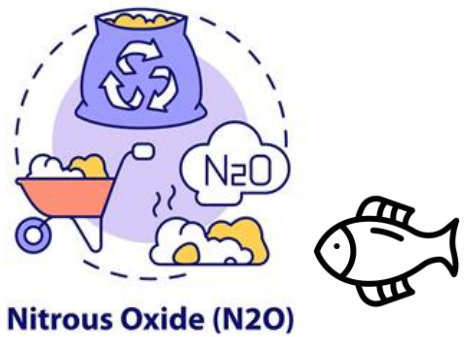
- Greenhouse Gases (Ag. & Energy)
  - » IPCC national inventories approach – All Farms
  - » Life Cycle Assessment (LCA) - Dairy
- Ammonia
  - » National inventories approach for all farms





2. Risk to water quality

- Farm gate input/output approach
- Balance / use efficiency of nitrogen & phosphorus



3. Biodiversity Indicator

- Framework being developed

Overview of Environmental Indicators

Indicator	Measure	Unit
Ag. GHG emissions per farm	Absolute GHG emissions per farm	Tonnes CO_2 equivalent / farm
Ag. GHG emissions per hectare	Absolute Ag. GHG emissions per hectare	Tonnes CO_2 equivalent / hectare
Ag. GHG emissions per kg / € of output	GHG emissions efficiency	kg CO_2 equivalent / kg output AND kg CO_2 e / € output
Energy GHG emissions per farm	Farm GHG energy use efficiency	kg CO_2 equivalent / kg output
Energy GHG emissions per hectare	Absolute Energy emissions per hectare	Tonnes CO_2 equivalent / hectare
Energy emissions per kg / € of output	Energy GHG emissions efficiency	kg CO_2 equivalent / kg output AND kg CO_2 e / € output
NH_3 emissions per farm	Absolute NH_3 emissions per farm	Tonnes NH_3 equivalent / farm
NH_3 emissions per hectare	Absolute NH_3 emissions per hectare	Tonnes NH_3 equivalent / hectare
NH_3 emissions per kg / € of output	NH_3 emissions efficiency	kg NH_3 equivalent / kg output AND kg NH_3 / € output
N balance	N transfer risk	kg N surplus / ha^{-1}
N use efficiency	N retention efficiency	% N outputs / N inputs
P balance	P transfer risk	kg P surplus / ha^{-1}
P use efficiency	P retention efficiency	% P outputs / P inputs

Methodological Developments – GHG Emissions

- IPCC updates state of knowledge every so often through an Assessment Report (AR) based on updated scientific knowledge

- Updates in methodology as move from AR4 to AR5
  - Change in global warming potential (GWP) of methane (CH_4) and nitrous oxide (N_20)
  - Base gas CO_2 (Carbon Dioxide) other gases CH_4 (Methane) & N_2O (Nitrous Oxide) converted in CO_2 equivalents to get everything into a common base

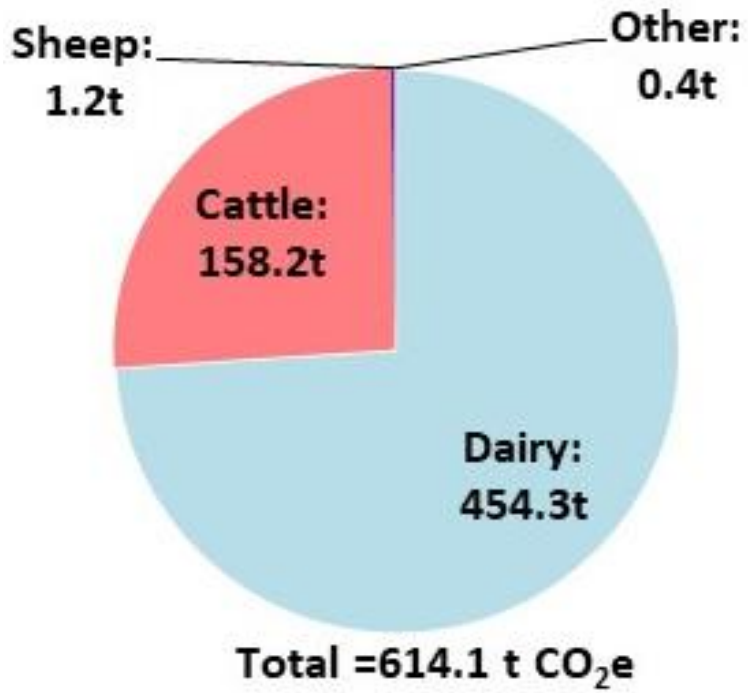
	AR4		AR5
CO_2 (Carbon Dioxide)	(1=1)	⟷	(1=1)
CH_4 (Methane)	(1=25)		(1=28) ↑
N_2O (Nitrous Oxide) ↓	(1=298)		(1=265)

- Adopted in Irish National Inventories (EPA) so this is replicated here
- Time series has been adjusted and back-casted
- Net impact is an increase in CO_2e for a given year over the time series

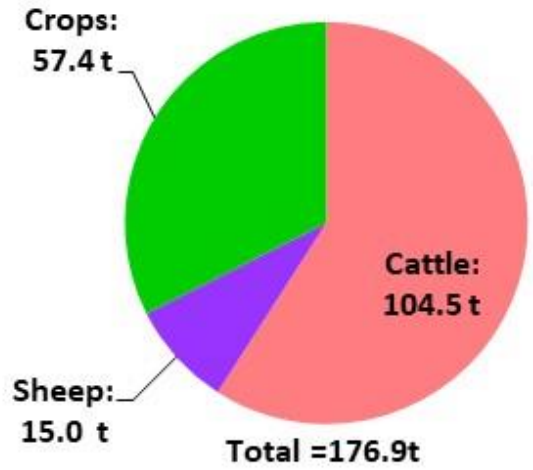
Environmental Sustainability – GHG Emissions

Ag GHG emissions	Measure	Unit
per farm	Absolute Ag. GHG emissions (IPCC methodology)	Tonnes CO_2 equivalent
per hectare	Ag. GHG emissions per hectare farmed (IPCC methodology)	kg CO_2 equivalent
per kg of output	Ag. GHG emissions efficiency (IPCC methodology)	kg CO_2 equivalent
per € output	Ag. GHG emissions efficiency (IPCC methodology)	kg CO_2 equivalent

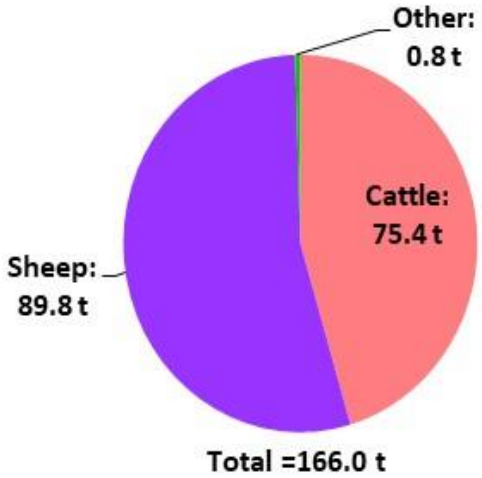
Dairy Farm Ag. GHG Emissions 2021



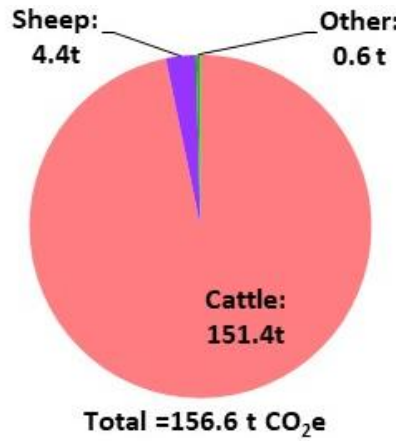
Tillage Farm Ag. GHG Emissions 2021

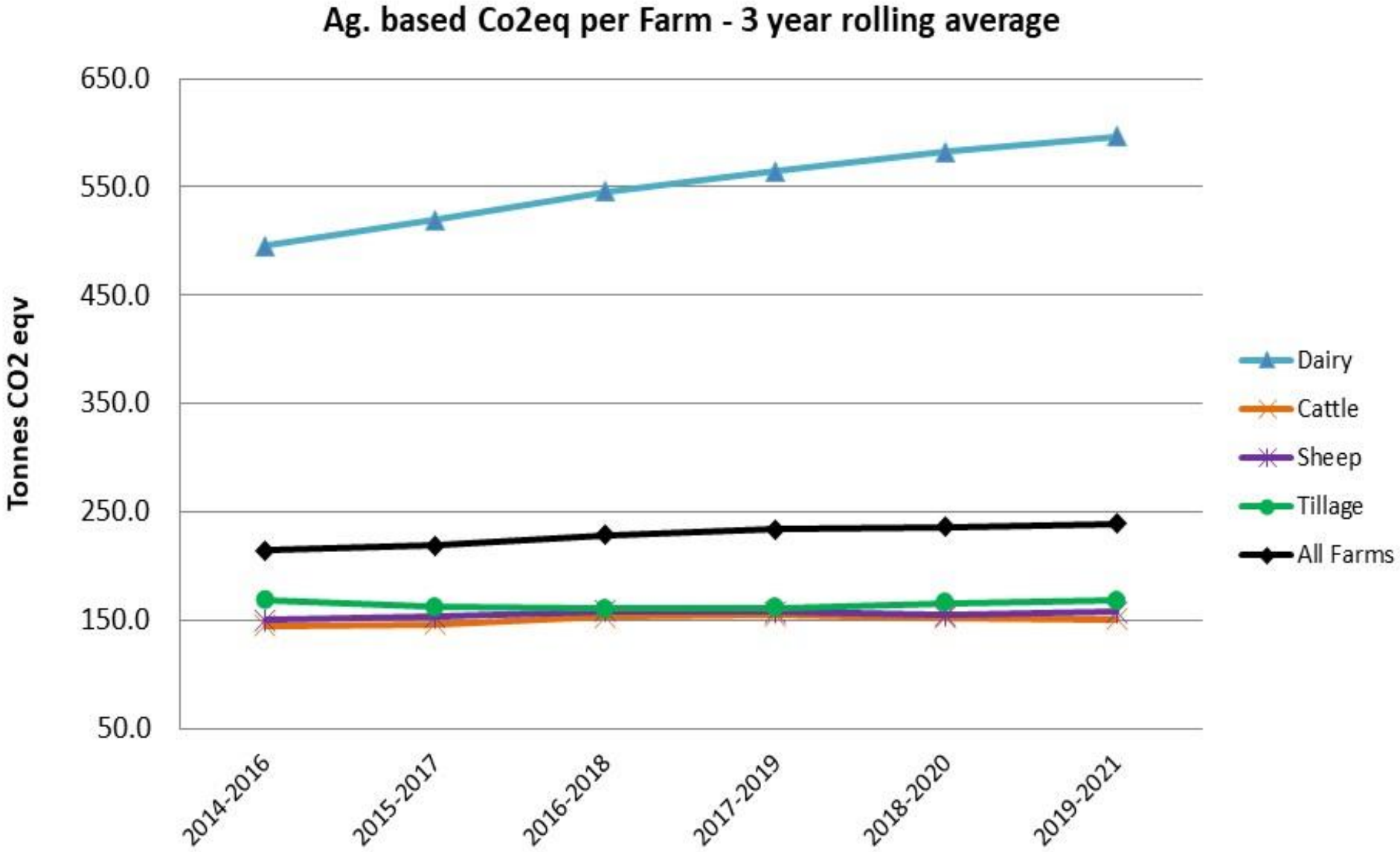


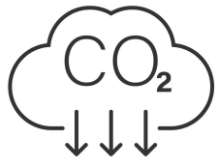
Sheep Farm GHG Emissions 2021

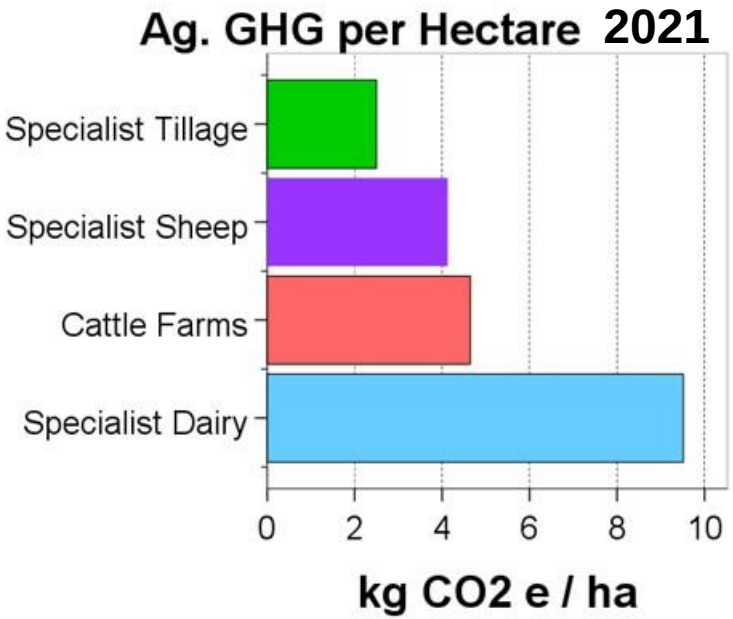


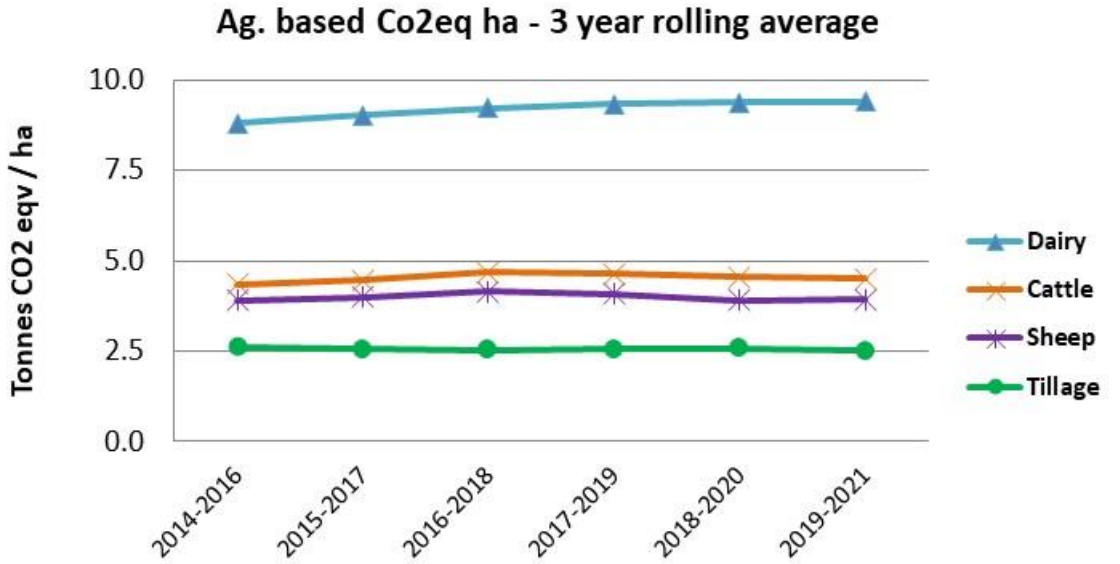
Cattle Farm Ag. GHG Emissions 2021

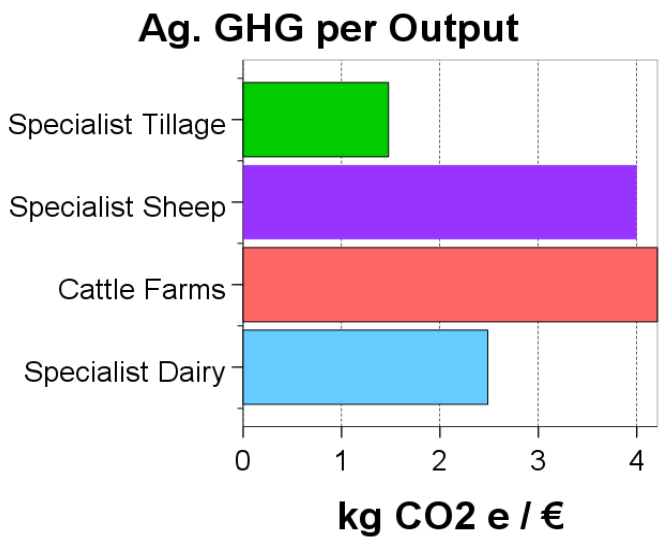


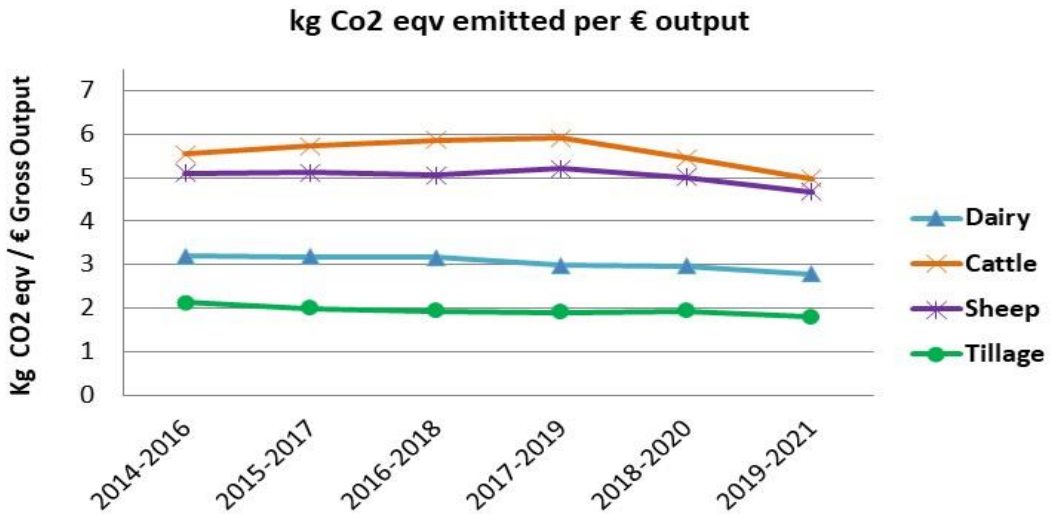












Dairy based Ag. GHG emissions - Components

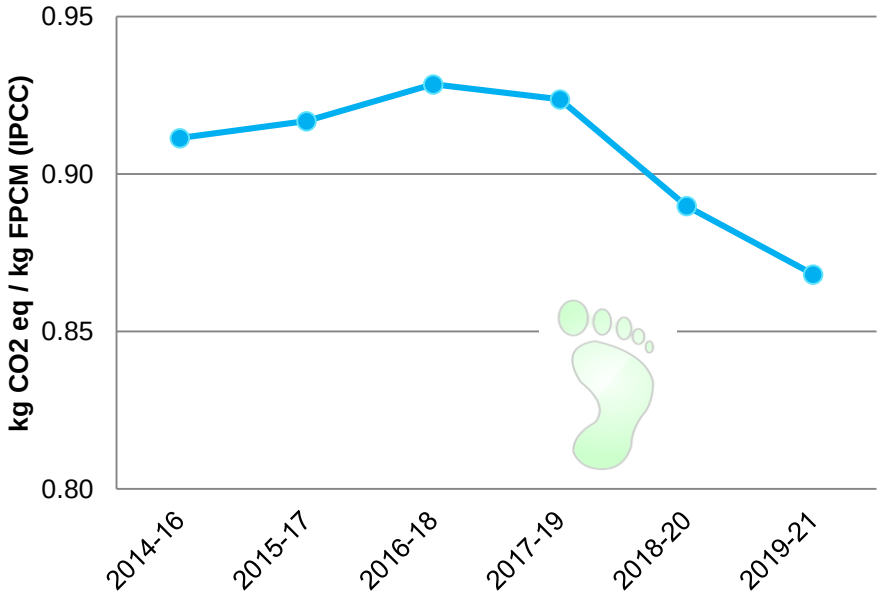
Dairy absolute GHG emissions equation = 3 Components

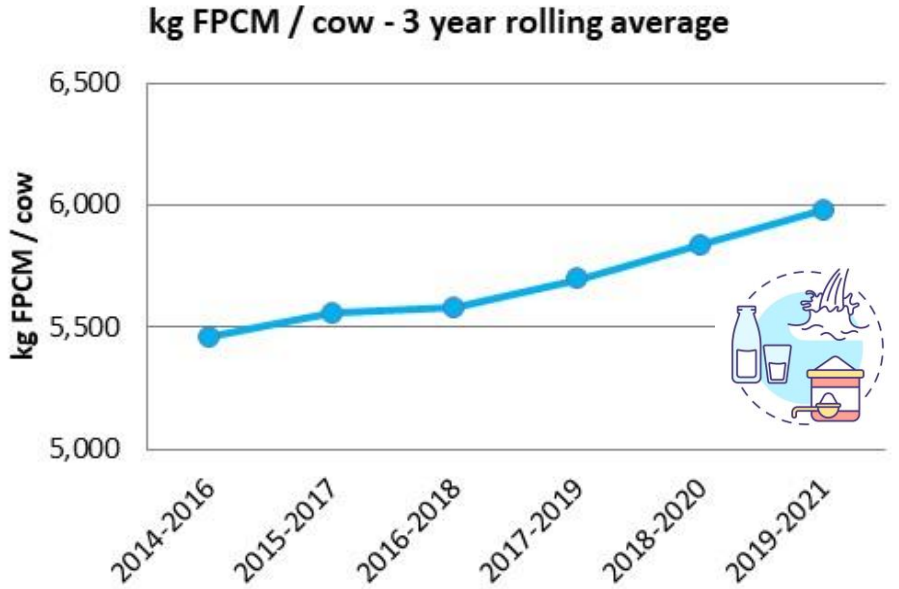
(1) kg of milk produced per cow *

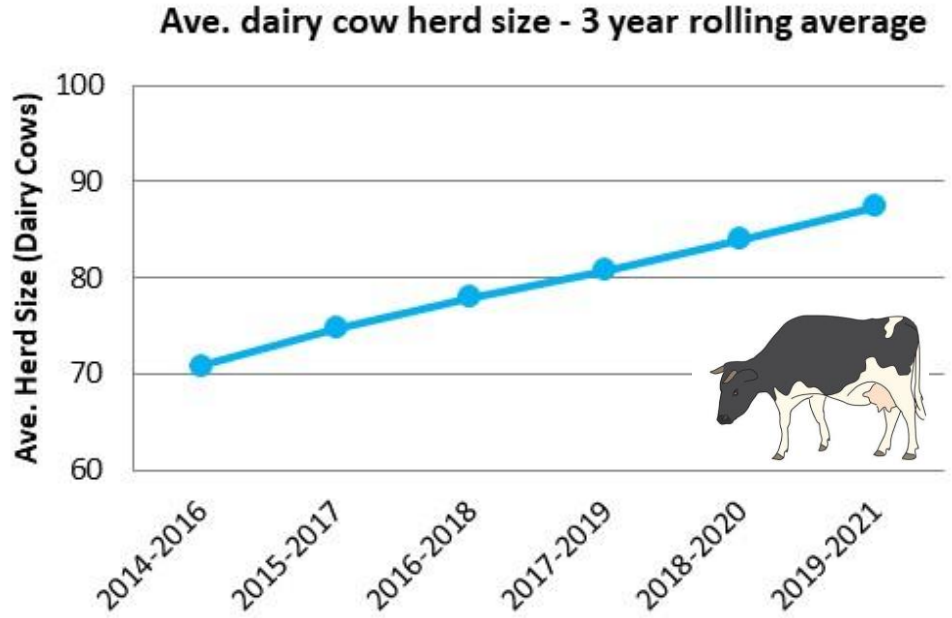
(2) CO_2e per kg of milk *

(3) No. of cows (Herd size)

***Kg of Fat & Protein Corrected Milk (FPCM) milk = Standardized to 4% fat and 3.3% protein.**



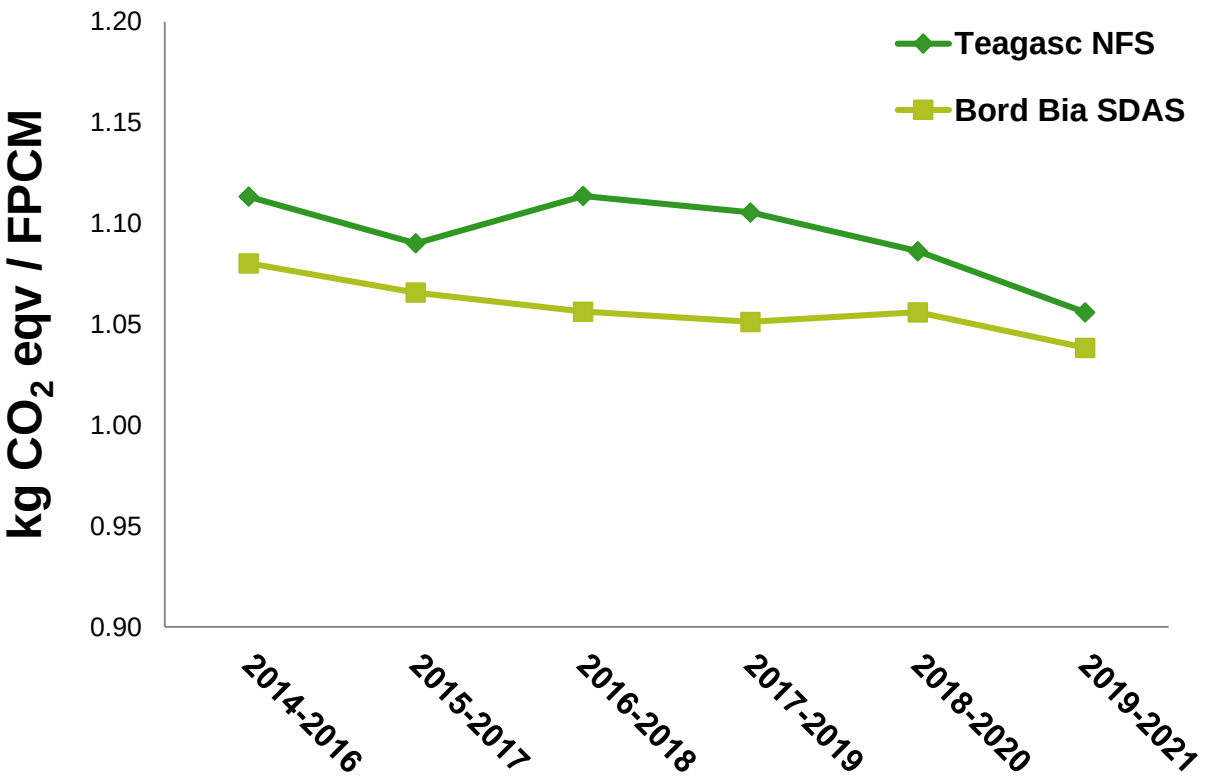




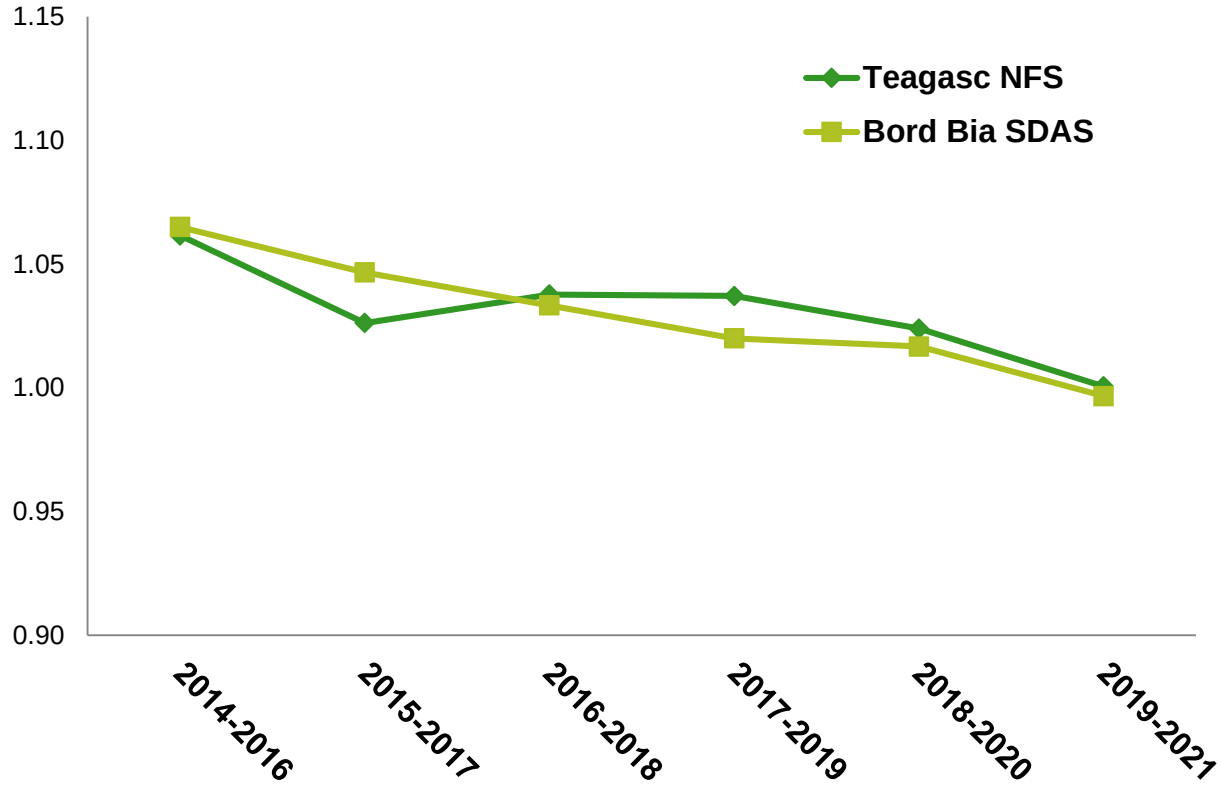
Carbon Footprint of Milk Production

National Cross Validation of LCA Approach

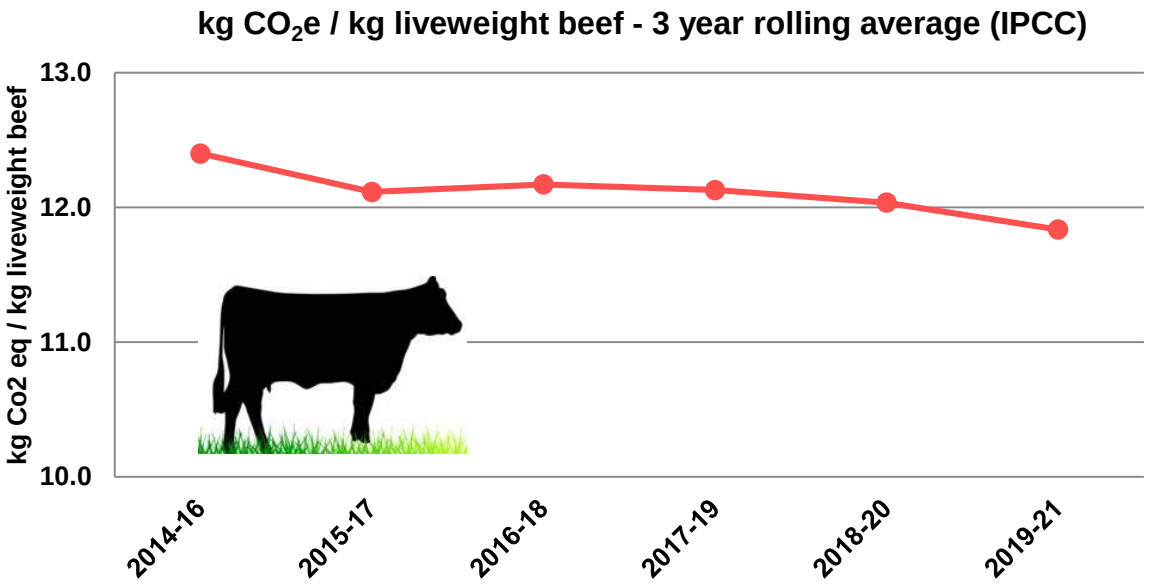
Average Dairy Farm

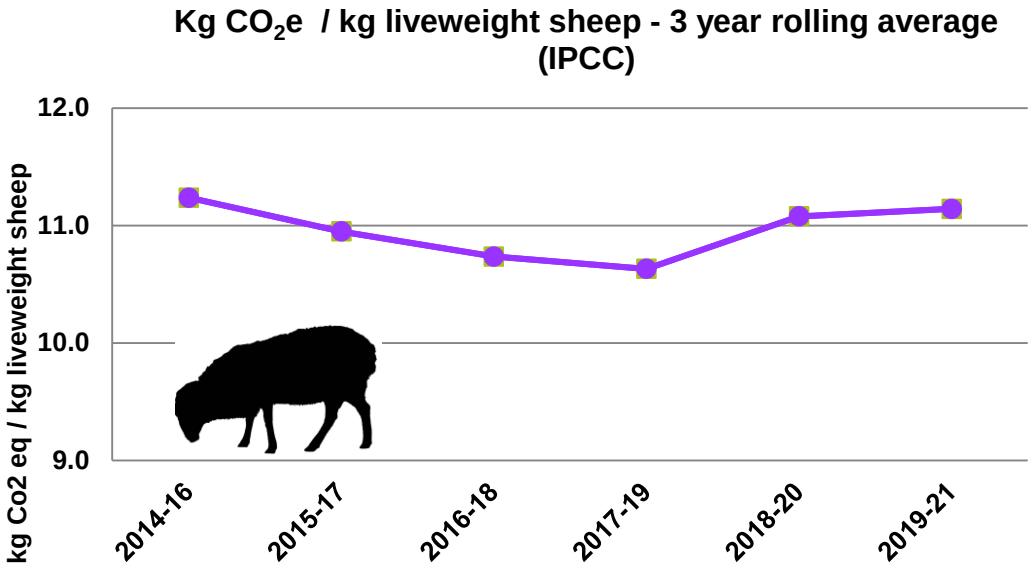


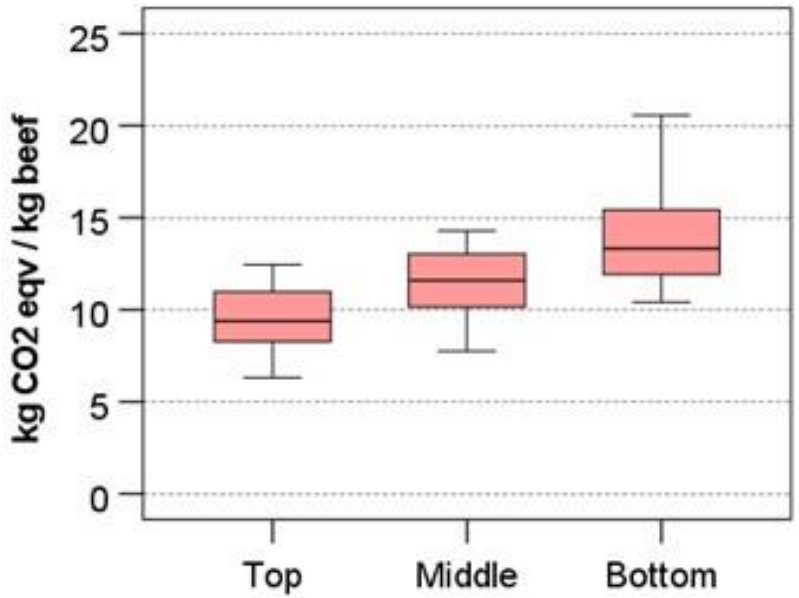
Aggregate average – Milk supply weighted

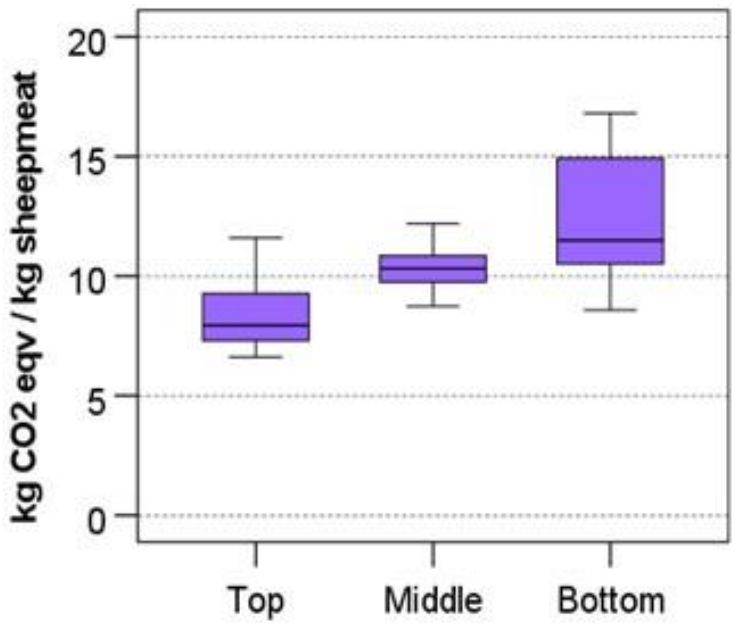


Ag. Emissions intensity – Cattle & Sheep





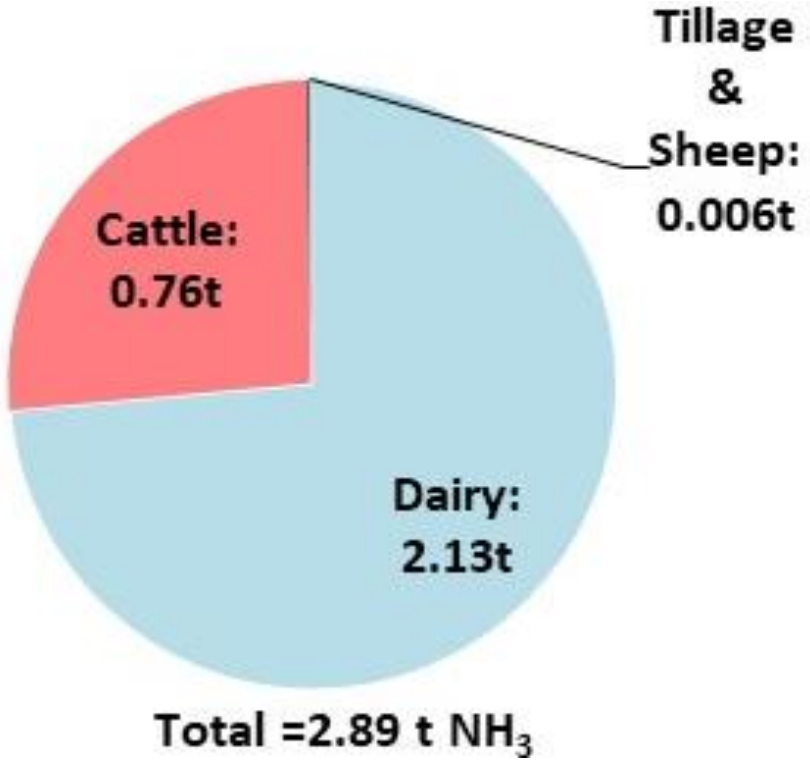




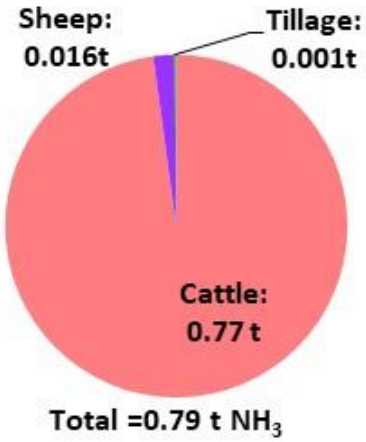
Ammonia Emissions

Ammonia emissions Indicators	Measure	Unit
per farm	NH_3 emissions	Tonnes NH_3 equivalent
per hectare	NH_3 emissions per hectare farmed	kg NH_3 equivalent
per kg of output	NH3 emissions efficiency on a kg of product basis	kg NH3
per € of output	NH_3 emissions efficiency on a Euro of output generated basis	kg NH_3

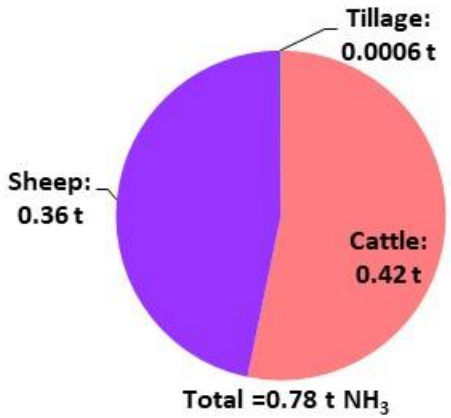
Dairy Farm NH_3 Emissions 2021



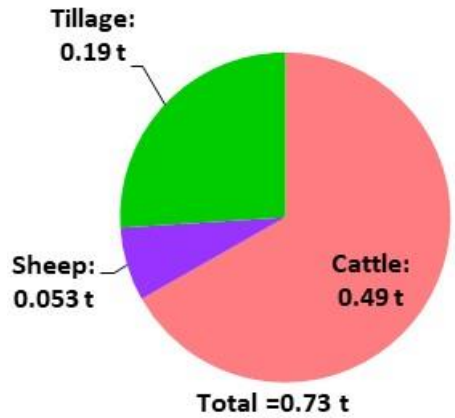
Cattle Farm NH_3 Emissions 2021



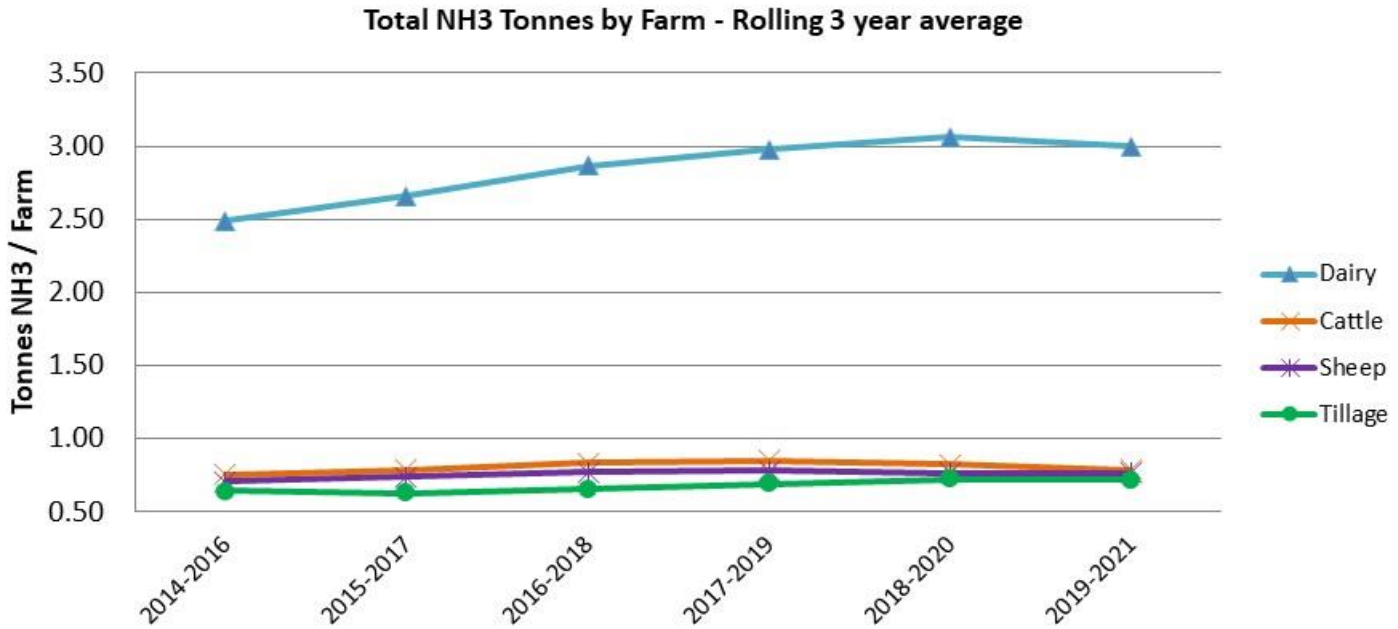
Sheep Farm NH_3 Emissions 2021

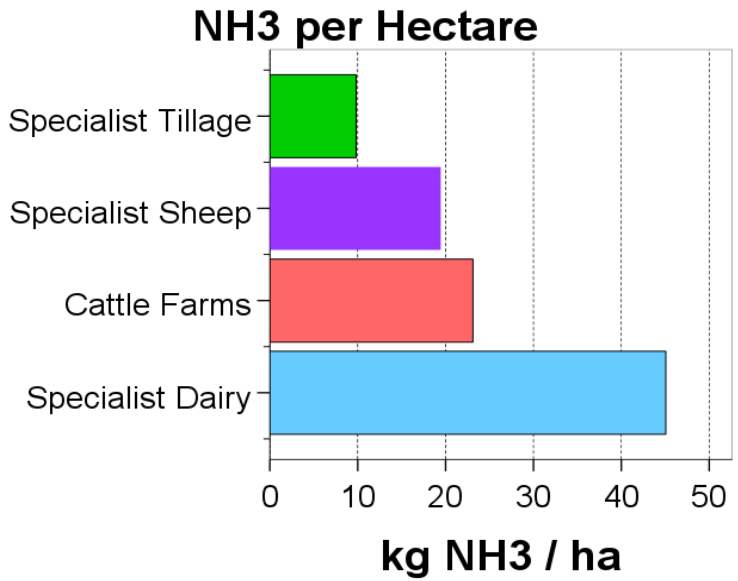


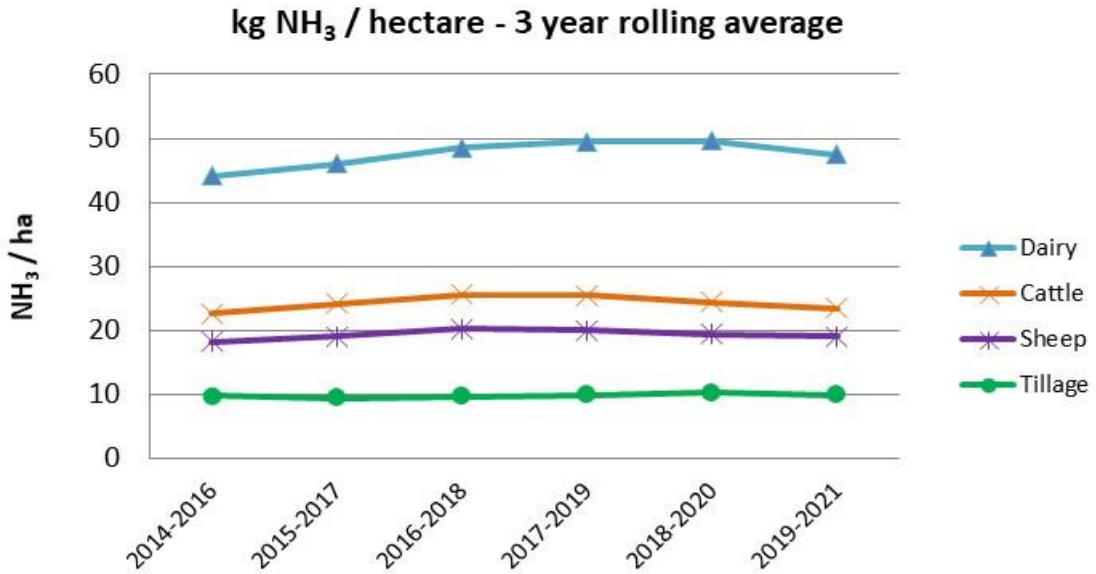
Tillage Farm NH_3 Emissions 2021



Trends in Farm and per hectare NH_3 emissions

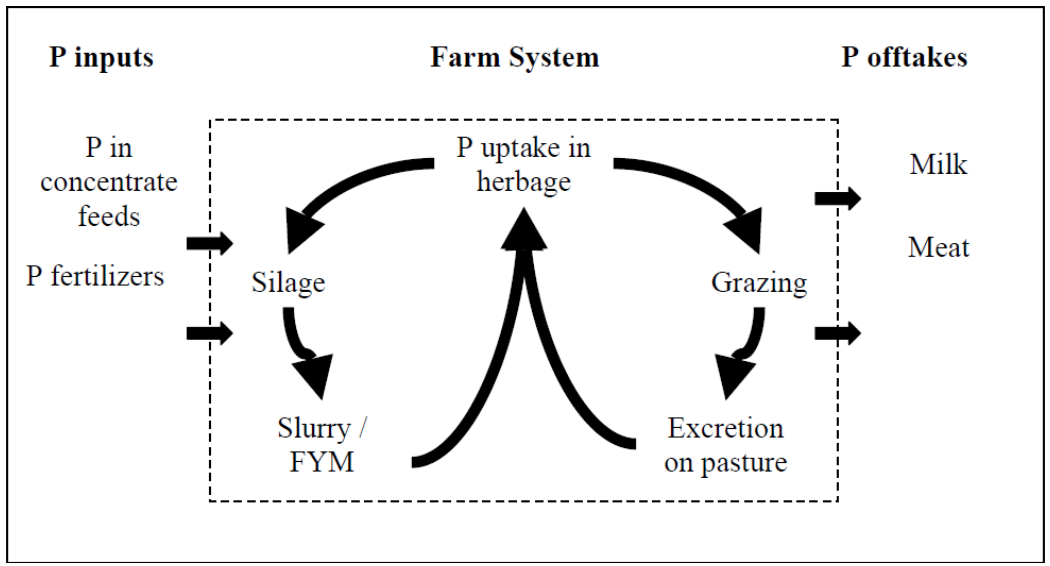






Environmental Sustainability – Risk to Water Quality

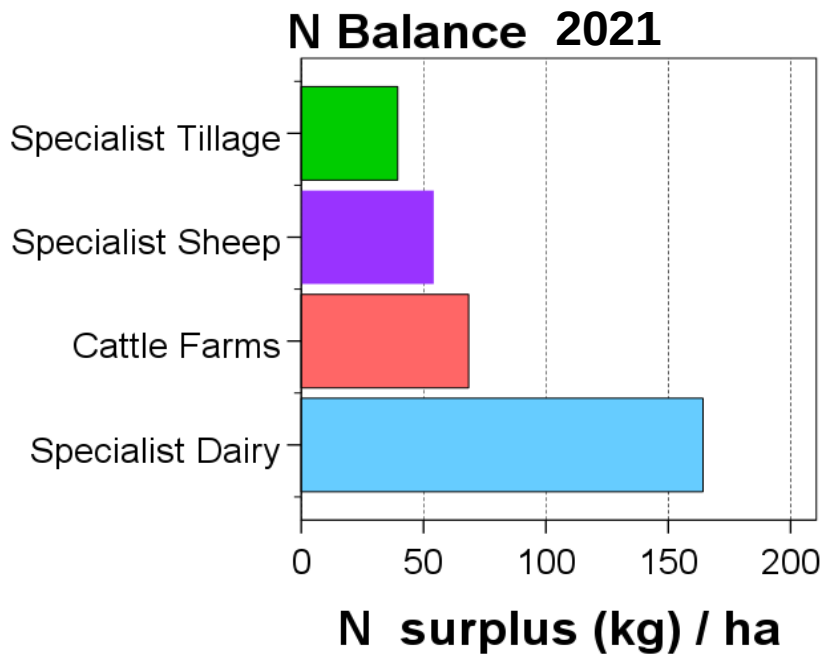
Indicator	Measure	Unit
Nitrogen (N) balance	N loss risk (Farm gate level)	kg N surplus/hectare
Phosphorus (P) balance	P loss risk (Farm gate level)	kg P surplus/hectare
Nitrogen (N) use efficiency	N application efficiency	% N outputs / N inputs
Phosphorus (P) use efficiency	P application efficiency	% P outputs / P inputs

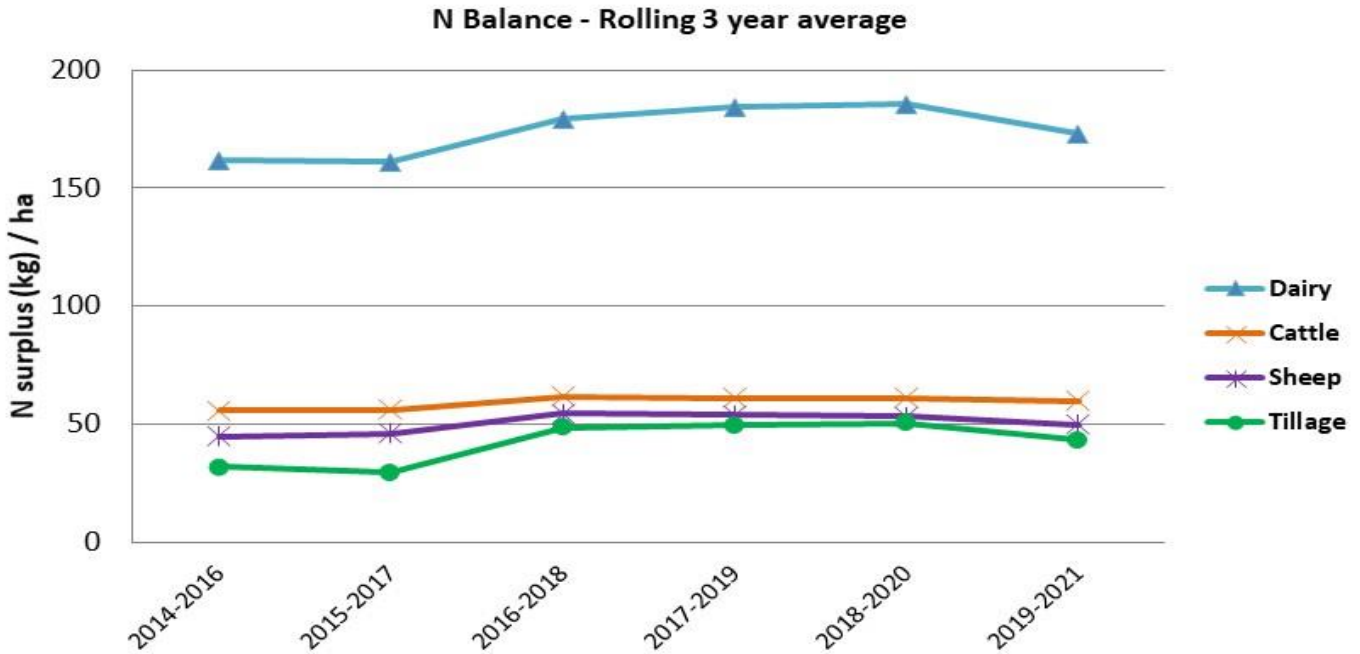


Source: Lalor and Coulter 2009

Nitrogen Balance

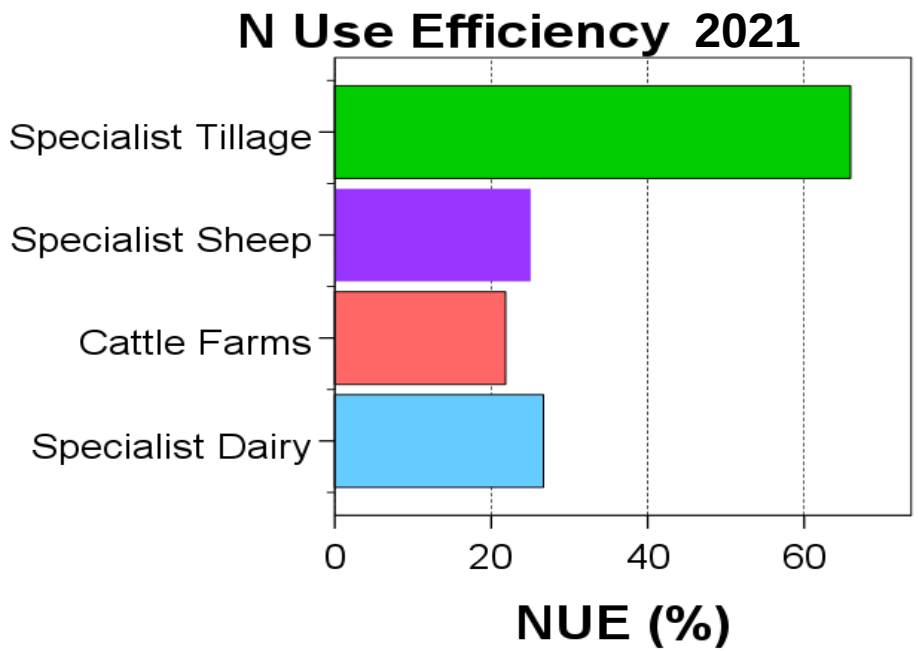
- N inputs – N outputs (farm-gate level), per hectare basis

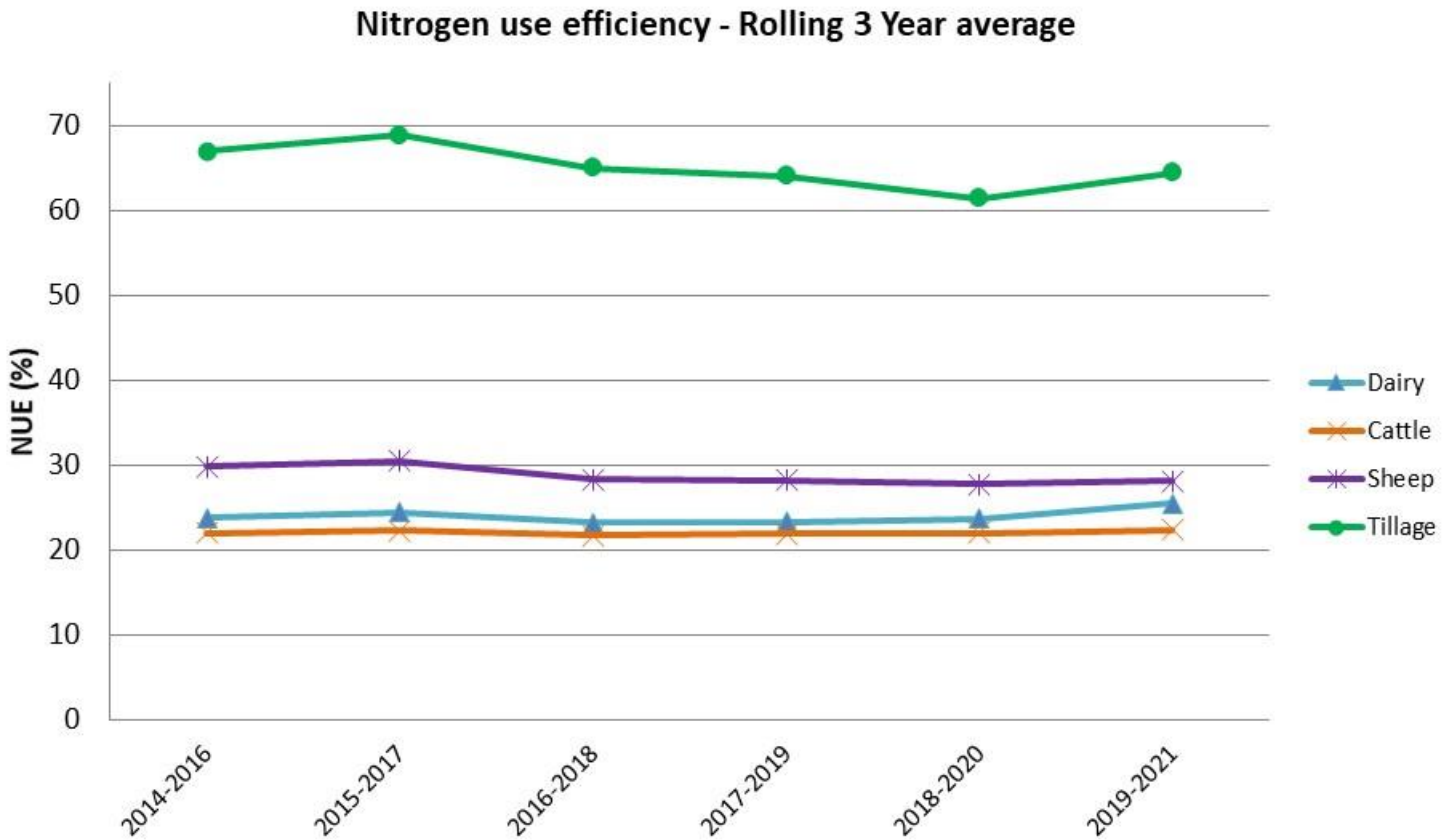




Nitrogen use efficiency

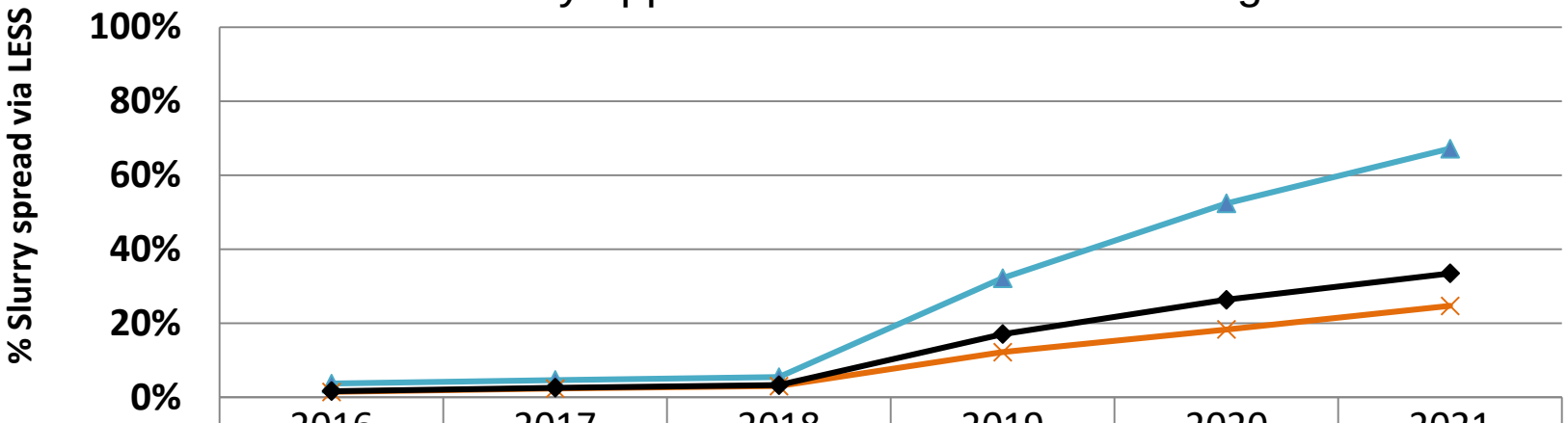
- Retention of N in farm system in % terms (output/input)





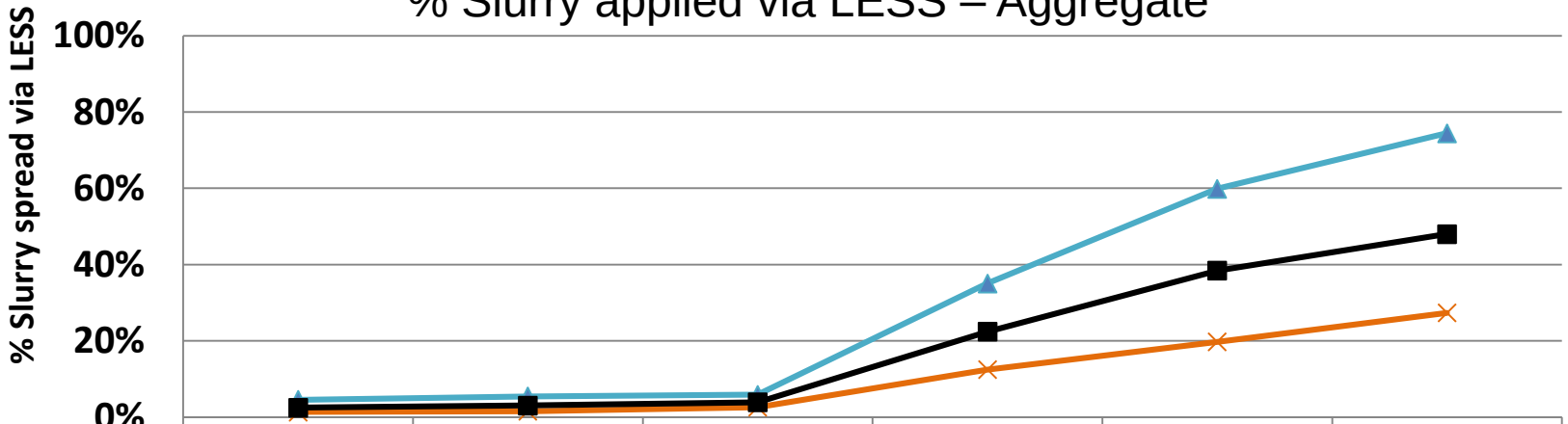
Innovation - LESS

% Slurry applied via LESS – Farm Average



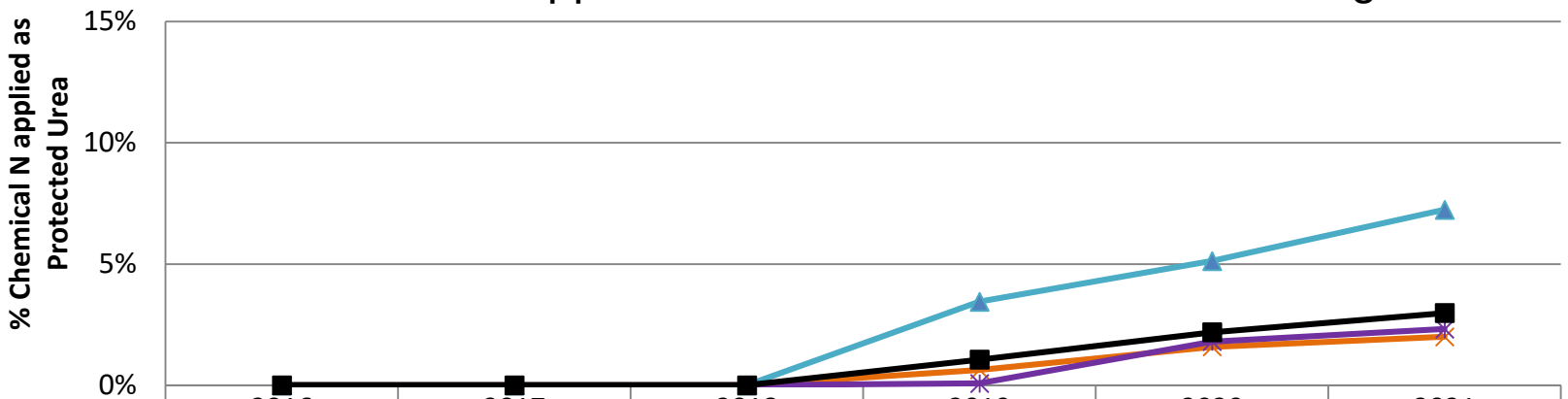
	2016	2017	2018	2019	2020	2021
Dairy	4%	5%	5%	32%	52%	67%
Cattle	1%	2%	3%	12%	18%	25%
All Farm	2%	3%	3%	17%	26%	33%

% Slurry applied via LESS – Aggregate

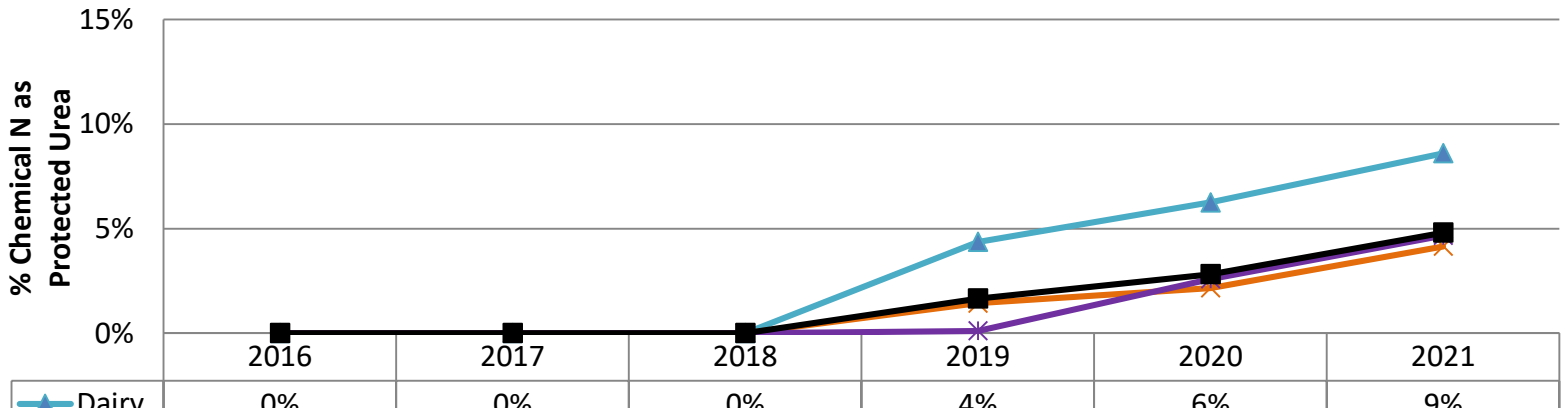


	2016	2017	2018	2019	2020	2021
Dairy	5%	5%	6%	35%	60%	74%
Cattle	1%	2%	3%	12%	20%	27%
Total	2%	3%	4%	22%	38%	48%

Innovation – Protected Urea



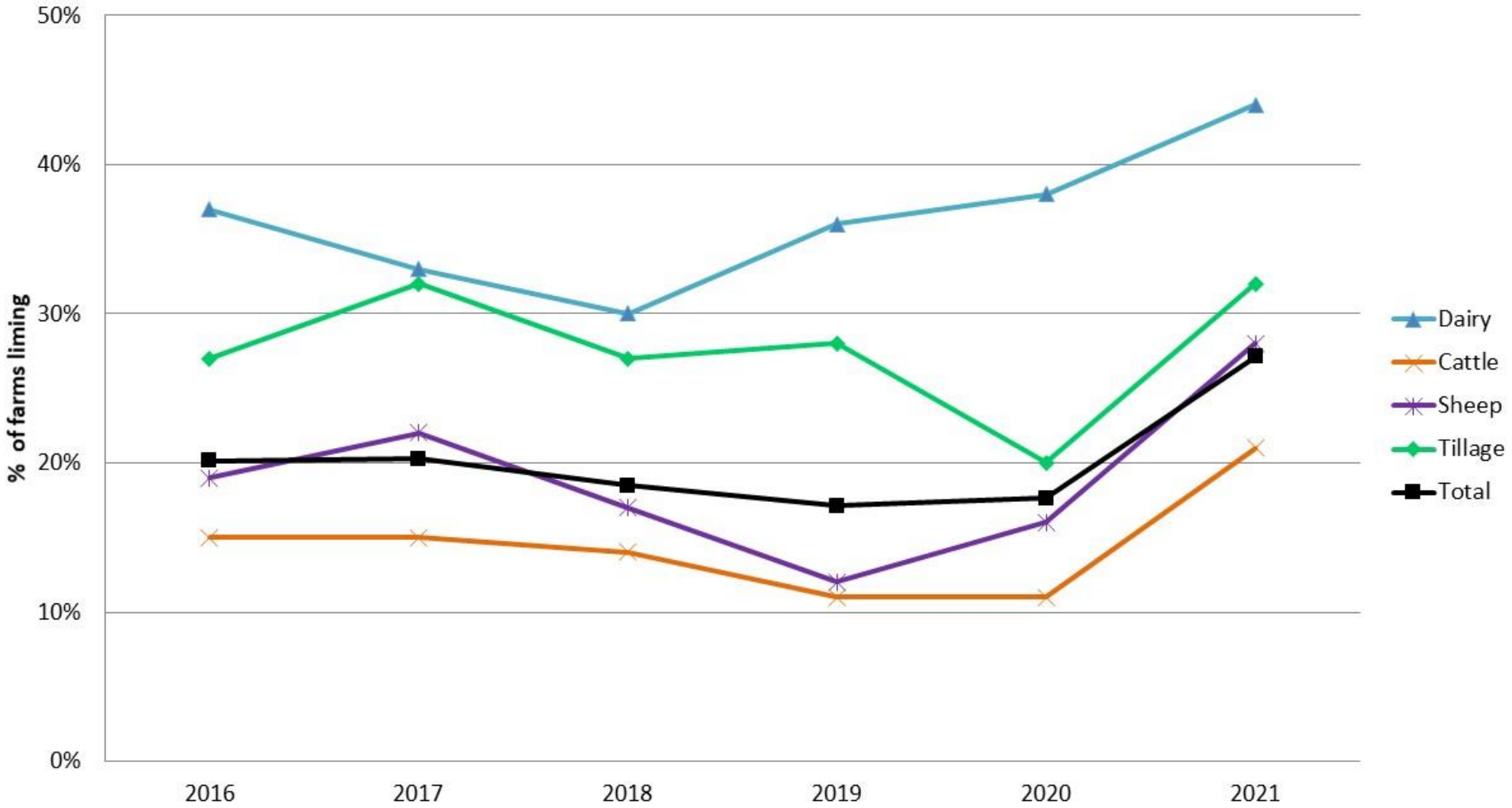
	2016	2017	2018	2019	2020	2021
Dairy	0%	0%	0%	3%	5%	7%
Cattle	0%	0%	0%	1%	2%	2%
Sheep	0%	0%	0%	0%	2%	2%
Total	0%	0%	0%	1%	2%	3%



	2016	2017	2018	2019	2020	2021
Dairy	0%	0%	0%	4%	6%	9%
Cattle	0%	0%	0%	1%	2%	4%
Sheep	0%	0%	0%	0%	3%	5%
Total	0%	0%	0%	2%	3%	5%

Agriculture and Food Development Authority

Liming Rates



Summary / Conclusion

- **Economic & Social Metrics:**
  - **Dairy** performs **strongest**
  - **Drystock** systems still the most **challenged**
- **Absolute GHG Emissions in 2021:**
  - Continued to increase on dairy farms at farm scale (driven by increased herd size) and increased liming rates
  - Other farm systems also up slightly (liming and stocking rate)
- **Absolute NH_3 Emissions in 2021:**
  - Generally declined on a per farm and per hectare basis (compared to preceding years)
- **Emissions intensity of production:**
  - GHG / NH_3 per kg product (milk & meat) is generally improving
- **Innovation Metrics:**
  - Use of **low emissions slurry spreading increased significantly**
  - **Protected Urea** use remains low but is increasing slowly
  - Significant increase in % of farms applying **lime**

Thank You

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https://www.teagasc.ie/rural-economy/rural-economy/national-farm-survey/sustainability-reports/