DAIRY 4 FUTURE FINALE CONFERENCE
« TACKLING THE CHALLENGES OF THE ATLANTIC AREA DAIRY SECTOR »

Impact of innovations on the environmental performance of pilot farms

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Presentation outline

- Characteristics of farm systems
- Carbon and ammonia footprints
- Land use
- Mitigation strategies

Policies for greenhouse gas mitigation in countries of the Atlantic Area

Country	Target reduction (%)	Baseline year	Targeted measures
Ireland	25	2018	Fertiliser N, manure management, genetic merit
UK	17-30	2019	Fertiliser N, manure management, agro-forestry
Spain	18	2005	Fertiliser N, manure management, more legumes
France	18	2015	Fertiliser N, manure management, bio-energy, agro-forestry
Portugal	11	2005	Fertiliser N, manure management, genetic merit, bio-energy

Farm systems

- Grazing: >60% grazing throughout the year
- Housed: 100% housed
- Mixed: <60% grazing & <100% housed

	Grazing	Mixed	Housed
Number of farms	17	17	40
Grazing time %	68	42	0

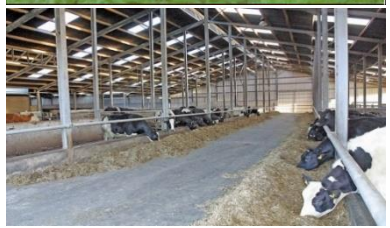
Farm Characteristics

	Stocking rate (LU/ha)	Milk production (kg FPCM/cow)	Age at first calving (months)	Youngstock (%)	Replacement rate (%)
Grazing	2.08	5,889	25	26	24
Mixed	1.98	8,371	28	31	28
Housed	5.17	9,777	27	34	31

Farm Characteristics

	Stocking rate	Grazing time	Concentrate	Purchased Forages	Fertilizer N
	(LU/ha)	(%)	(kg DM/LU)	(kg DM/LU)	(kg/ha)
Grazing	2.08	67	985	374	215
Mixed	1.98	42	2,242	310	132
Housed	5.17	0	3,298	1,234	123

Life Cycle Assessment (LCA) methodology



Primary resources
Raw materials
Energy use
Transport

Inputs
Fertilizers
Electricity
Fuel
Feeds

kg of milk

Surplus calves
Cull cows

Carbon footprint: per kg milk metric

- Efficiency of milk production
- Marketing

- Favours intensive farming?
- Impact to land not accounted for

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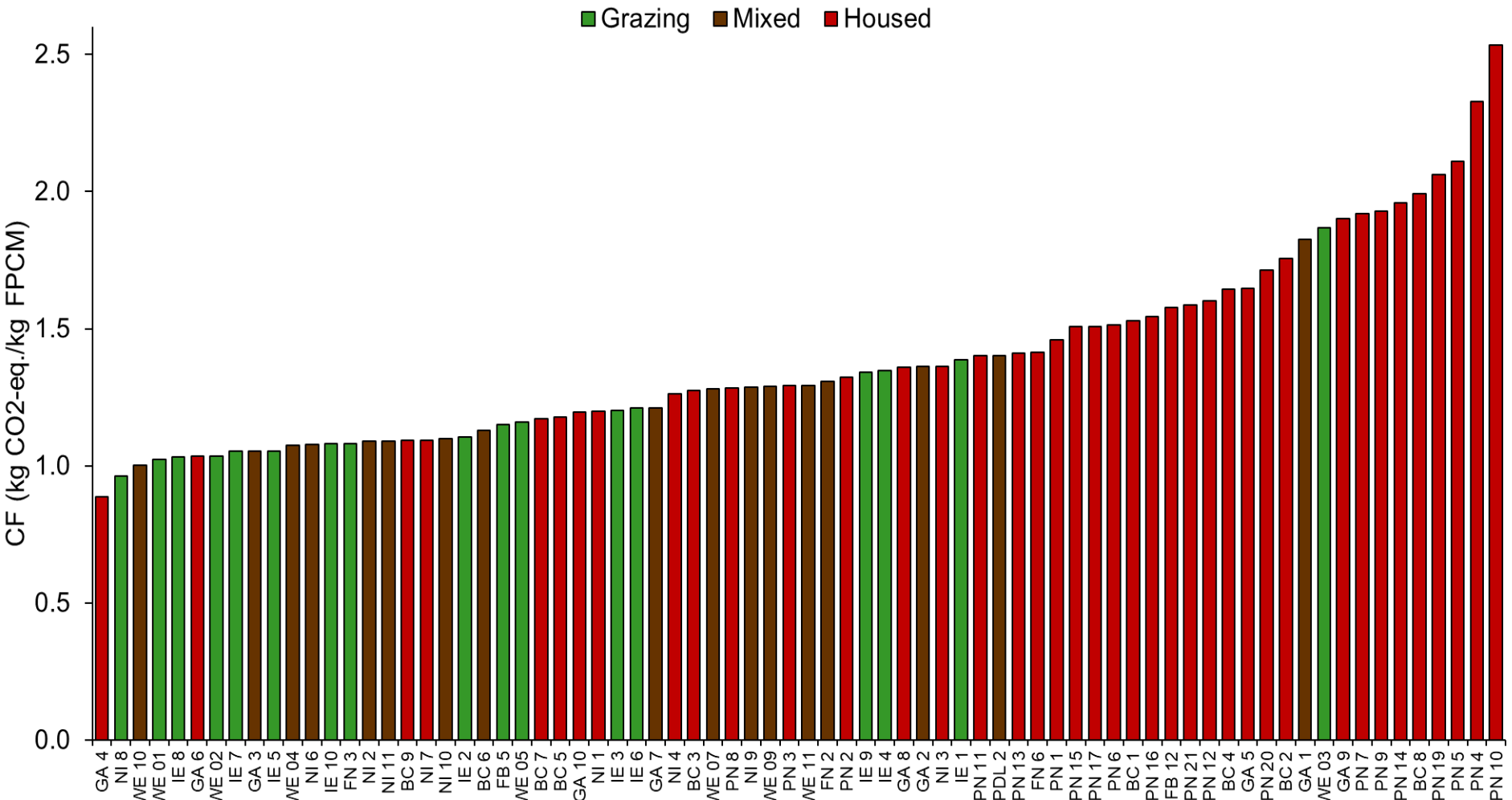
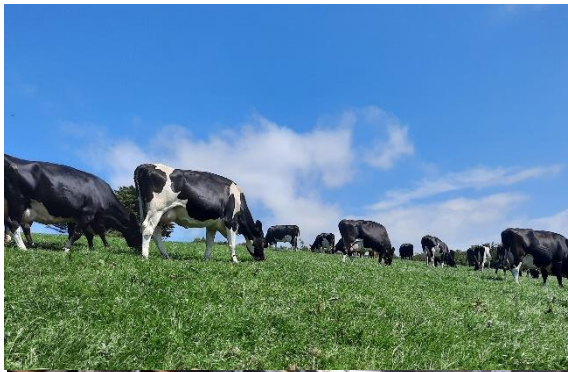
Carbon footprint per kg milk

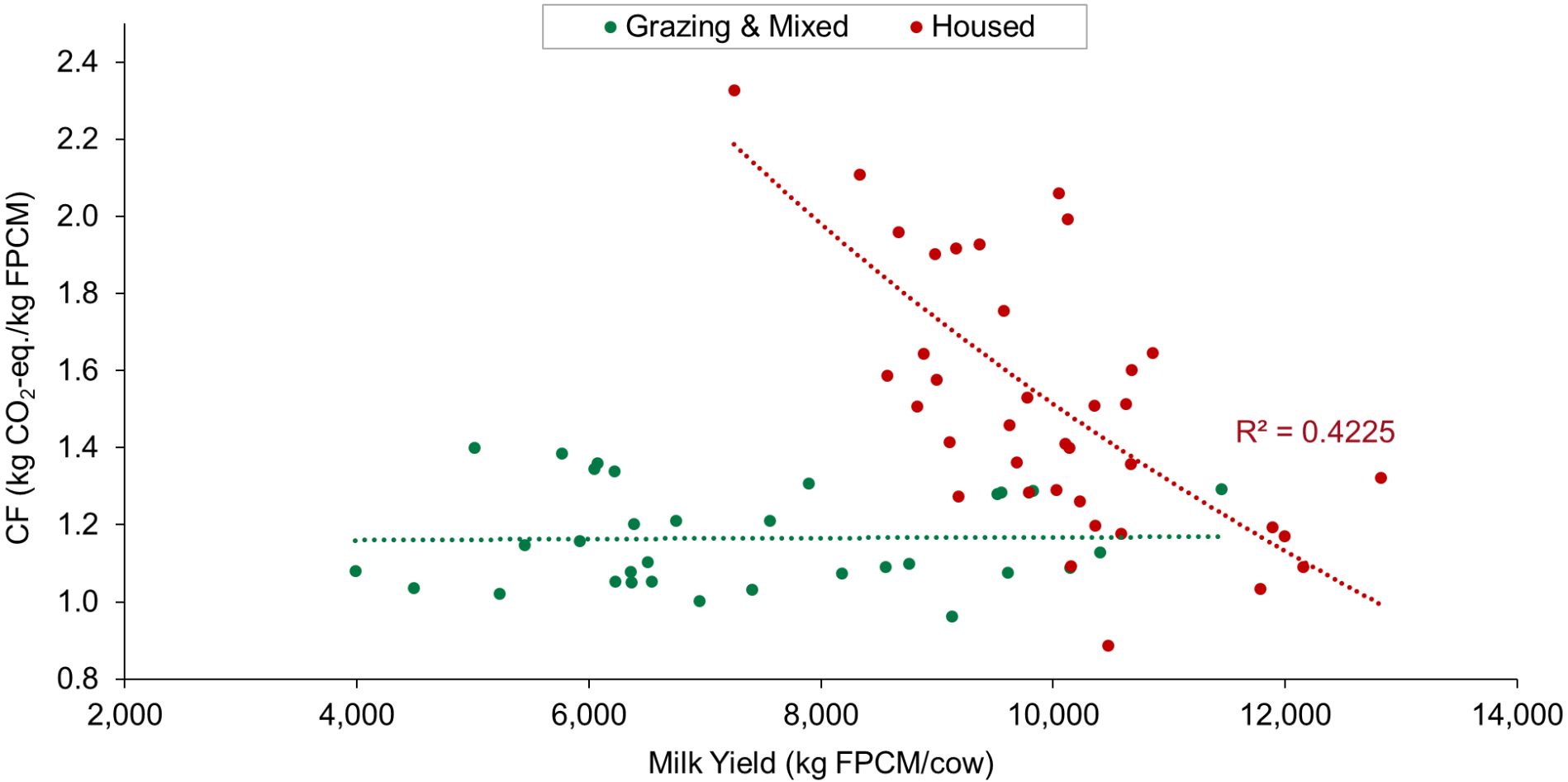


ANOVA analysis: Carbon footprint per kg milk

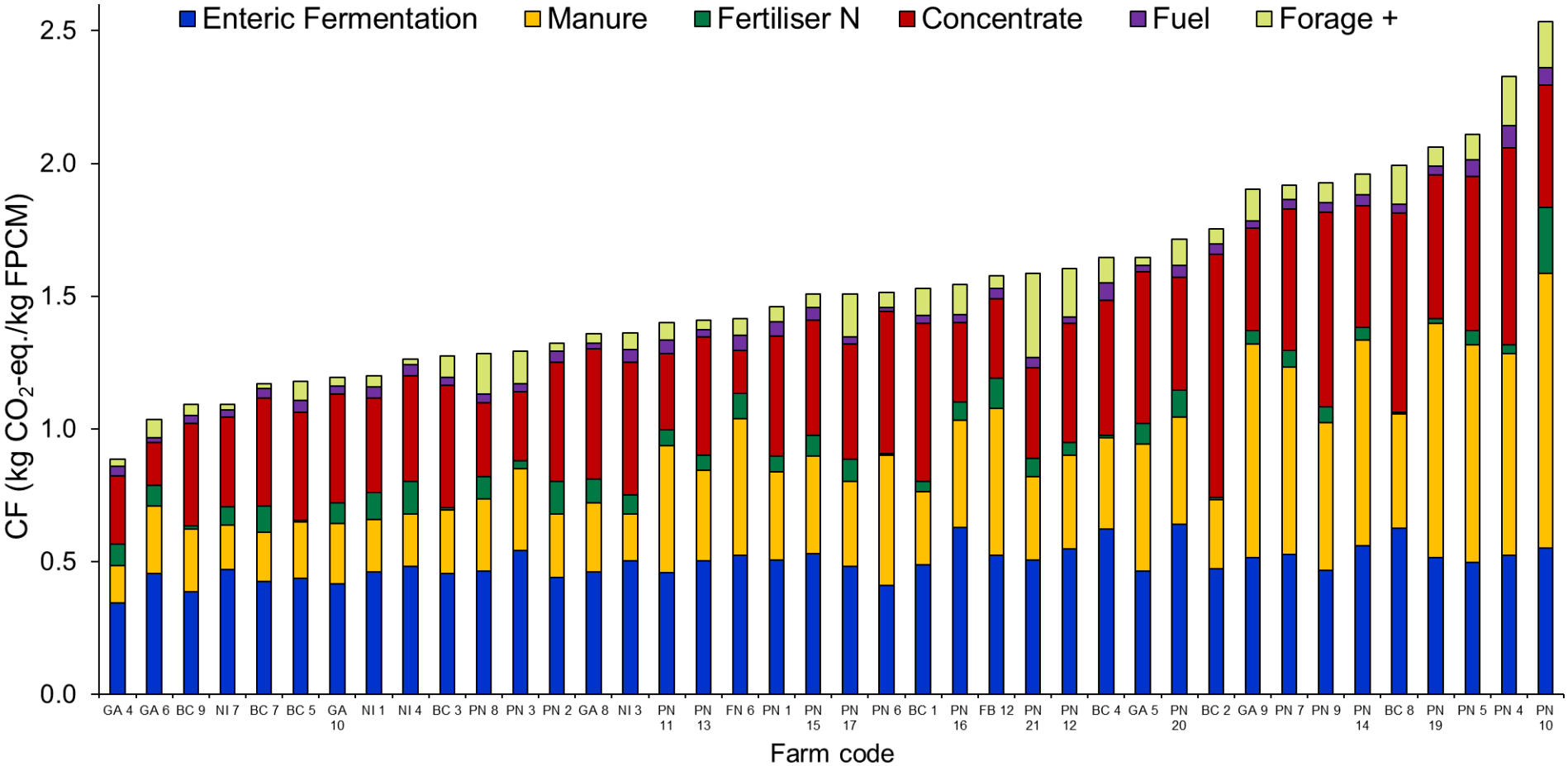
	Mean	Min	Max	SEM	P value
Grazing	1.14[a]	0.96	1.87		
Mixed	1.23[a]	1.00	1.83		
Housed	1.52[b]	0.89	2.54		
				0.07	***



The effect of milk yield on carbon footprint of milk



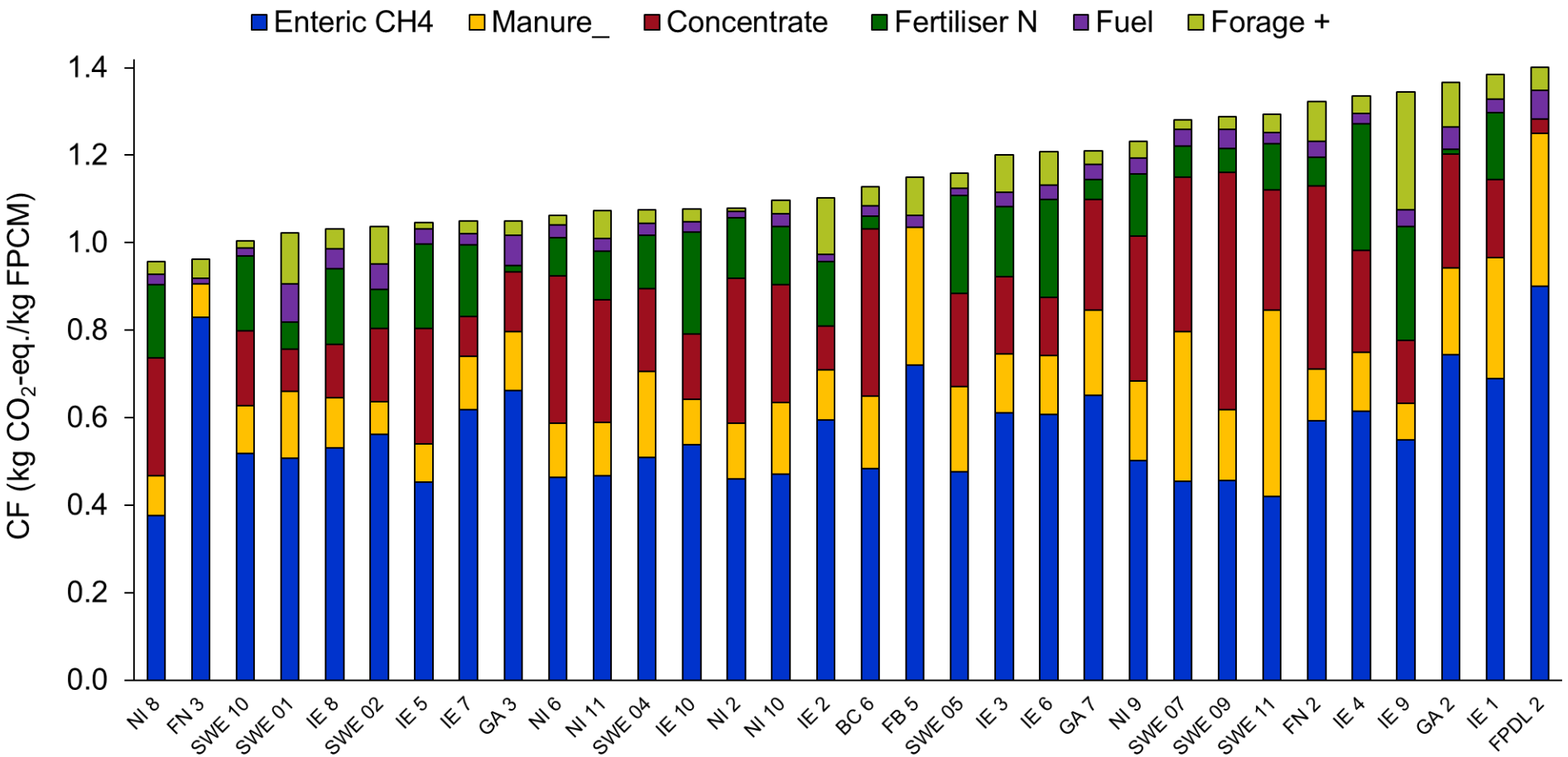
Housed: Carbon footprint per kg milk emissions profile



Regression analysis: Factors affecting CF per kg FPCM

Housed	***b***	**SE**	**p-Value**	**R^2**
Intercept	7.950	2.170	< 0.001	
Ln Milk yield per cow (kg FPCM/cow)	-1.612	0.604	0.012	0.03
Feed efficiency (kg FPCM/kg DMI)	-0.744	0.239	0.004	0.36
Age at first calving (months)	0.019	0.009	0.048	0.0001
Uncovered slurry proportion (%)	0.552	0.081	< 0.001	0.28
Concentrate/LU (kg/LU)	1.21×10^{-4}	2.80×10^{-5}	< 0.001	0.12
Adjusted R^2 multi-regression analysis			<0.001	**0.75**

Grazing & Mixed: Carbon footprint per kg of milk emissions profile



Regression analysis: Factors affecting CF per kg FPCM

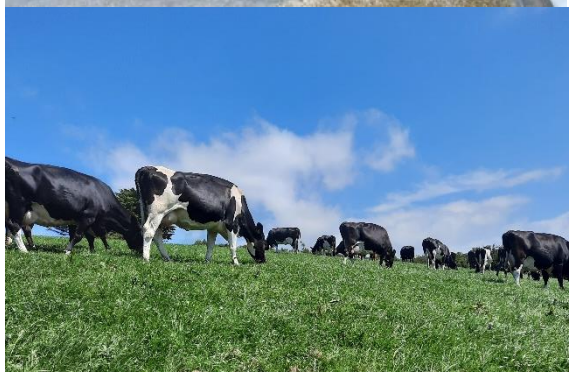
Grazing & mixed	*b*	SE	p-Value	R^2
Intercept	0.200	0.135	< 0.001	
Feed Efficiency (kg FPCM/kg DMI)	-0.192	0.079	0.087	0.37
N surplus (kg/ha)	6.64×10^{-4}	2.10×10^{-4}	0.004	0.02
Age at first calving (months)	4.21×10^{-2}	0.0001	< 0.001	0.16
Adjusted R^2 multi-regression analysis				**0.50**

Land use

- Land is an important resource!
- Food production
- Carbon sinks
- Renewable energy production

ANOVA analysis: Global land use (m^2/kg FPCM)

	Mean	Min	Max	SEM	P value
Grazing	1.14^{ab}	0.71	1.96		
Mixed	1.23^{a}	0.73	2.61		
Housed	0.89^{b}	0.54	1.23		
				0.85	**



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Ammonia

Ammonia is a transboundary gas and affects:

- Air quality
- Water quality
- Indirectly, global warming

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ANOVA analysis: Ammonia emissions kg NH_3/ t FPCM

	Mean	SEM	P value
Grazing	4.76[a]		
Mixed	5.69[a]		
Housed	7.31[b]		
		0.85	**

Regressions analysis: Ammonia emissions kg NH_3/ t FPCM

kg NH_3 / t FPCM	P-value	R^2
N surplus		
Low emission slurry spreading use		
	***	0.40

Summary

- Large data set with detailed data at farm level
- Feed efficiency and age at first calving important factors in both systems
- N surplus → grazing and mixed systems
- Milk yield, slurry storage, concentrate feed → Housed systems
- Multi-faceted issue → more analysis needed




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Thank you to all the farmers that participated and partners, technicians and advisors involved in the study

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