Carbon footprints of dairy farms along the Atlantic coast of Europe

Waterford Institute of Technology
INSTITIÚID TEICNEOLAÍOCHTA PHORT LÁIRGE

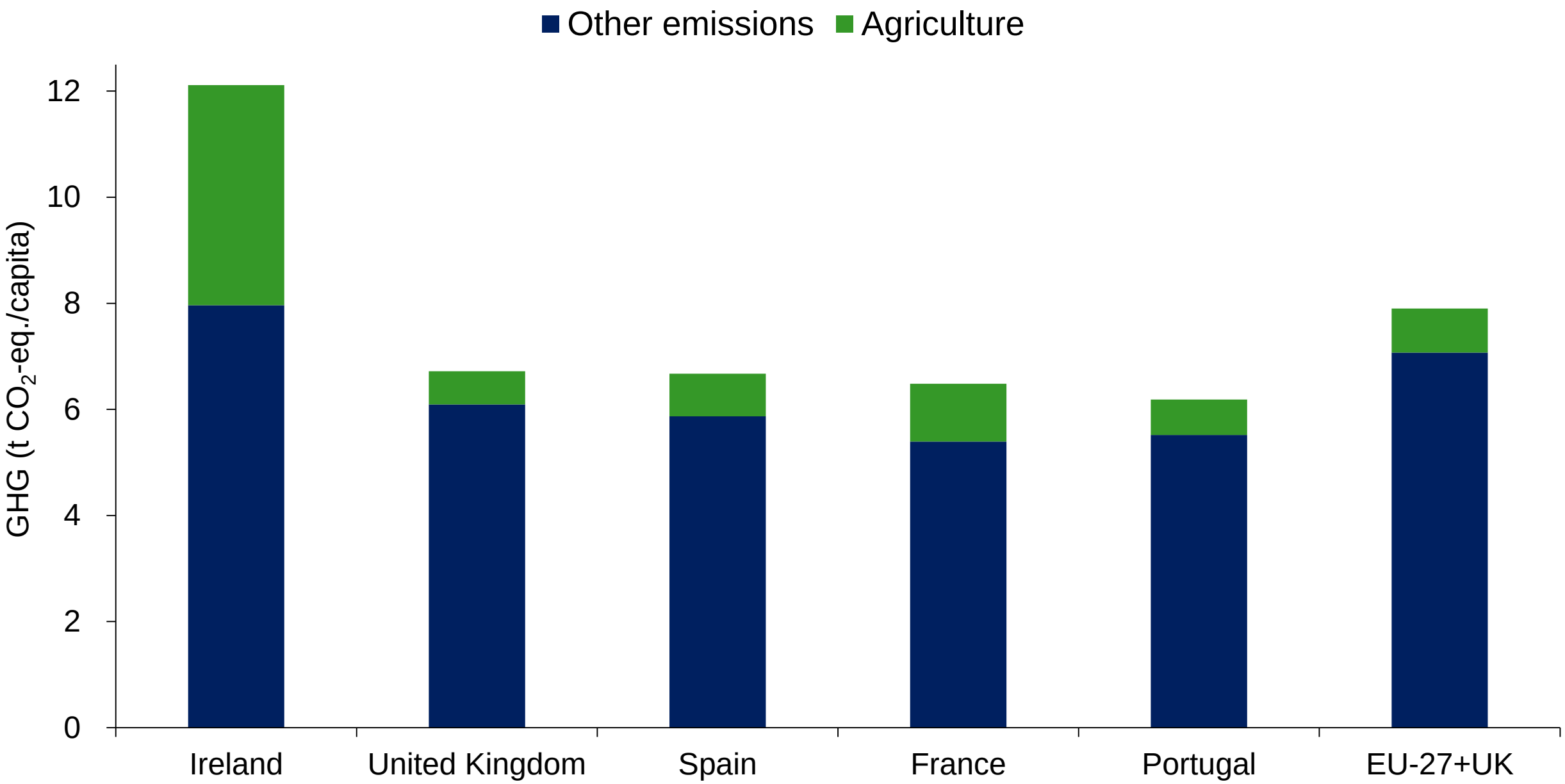
Teagasc
Agriculture and Food Development Authority

Dairy 4 future

Dairy-4-Future project

- 100 commercial dairy farms
- 10 experimental dairy farms
- Funded by the Interreg Atlantic Area Program

Per capita greenhouse gas emissions in countries in the Atlantic Area

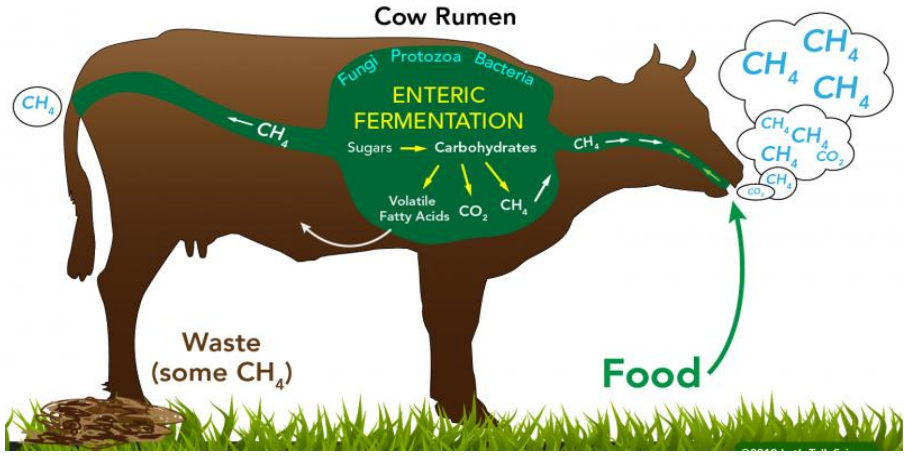


Policies for greenhouse gas mitigation in countries of the Atlantic Area

Country	Target reduction (%)	Baseline year	Targeted measures
Ireland	22-30	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

Aims & objectives

- Study of carbon footprints of milk from dairy farms
- Lower greenhouse gas emissions from dairy farms
- Study practices on dairy farms to identify best practices
- Need a range of diverse practices
- Specific solutions to farming system (pasture-based, indoor etc.)
- Also studying economic & social implications



Calculating a Carbon footprint

- Carbon footprint metric – e.g. per kg milk or per ha of land
- FPCM = Fat and Protein Corrected Milk

Accounting for greenhouse gas emissions

Primary resources
Raw materials
Energy use
Transport

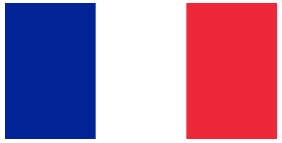
Inputs
Fertilizers
Electricity
Fuel
Feeds

Agriculture and Food Development Authority

Number of farms per region

Ireland	10

N. Ireland	10
Great Britain	9



France	6

Galicia	10
Basque	9

Portugal	20
Total	74

- More progressive farms
- Diversity of systems
- Wide range of practices
- Not necessarily representative of dairy farms in each region

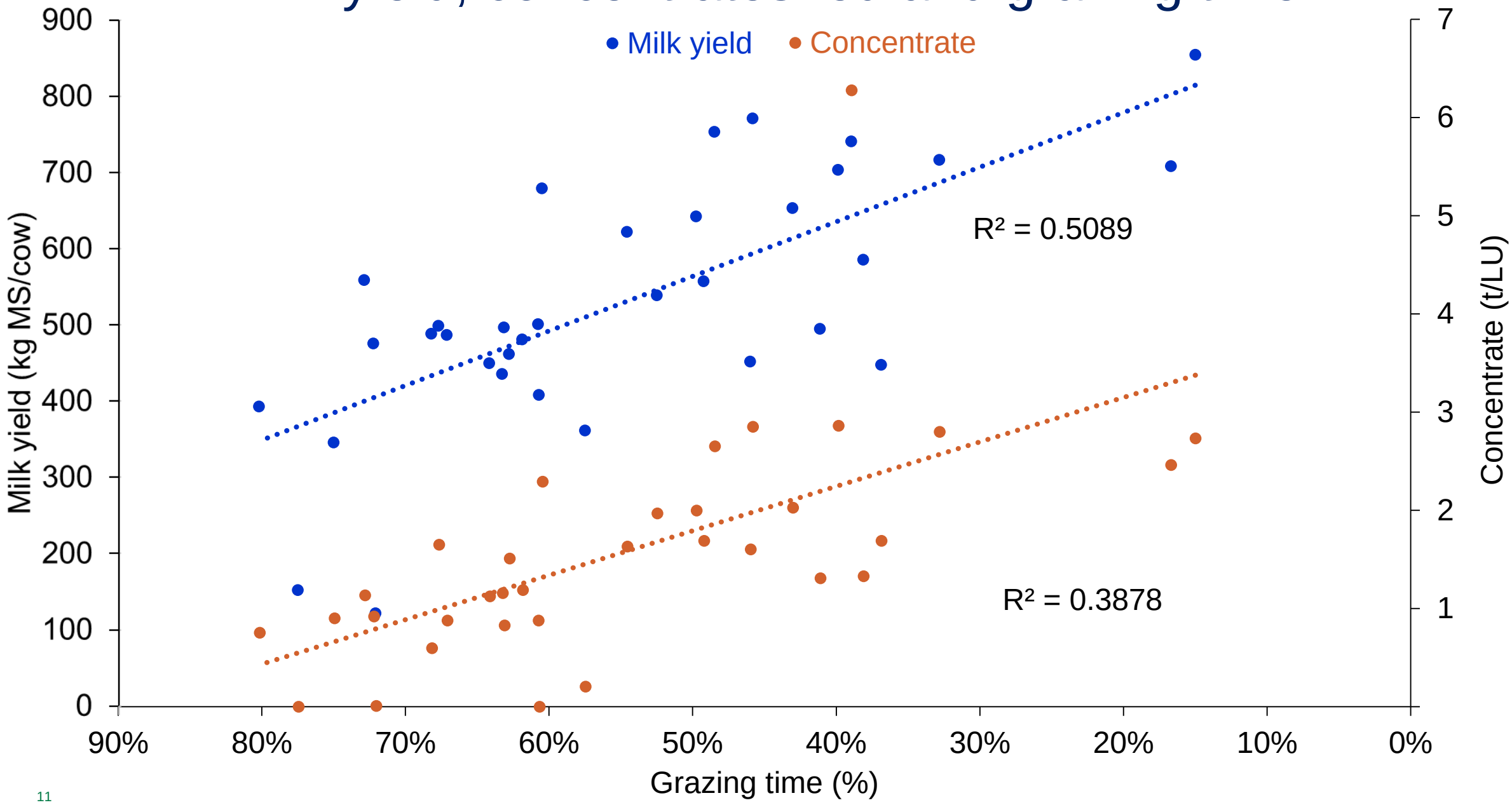
Farm Characteristics

	Stocking rate (LU/ha)	Milk solids production (kg/cow)	Age at first calving (months)	Youngstock (%)	Replacement rate (%)
Ireland	2.36	488	24	25	22
N. Ireland	2.22	714	27	33	30
Great Britain	2.13	530	26	31	28
France	1.51	476	28	27	24
Galicia	2.25	677	29	26	23
Basque	3.52	759	26	41	37
Portugal	7.84	685	28	33	30

Farm Characteristics

	Stocking rate (LU/ha)	Grazing time (%)	Concentrate (kg DM/LU)	Purchased Forages (kg DM/LU)	Fertilizer N (kg/ha)
Ireland	2.36	66	966	421	270
N. Ireland	2.22	25	2,425	159	189
Great Britain	2.13	55	1,825	150	175
France	1.51	39	632	771	35
Galicia	2.25	17	2,466	466	80
Basque	3.52	5	3,561	1,150	45
Portugal	7.84	0	2,757	2,042	163

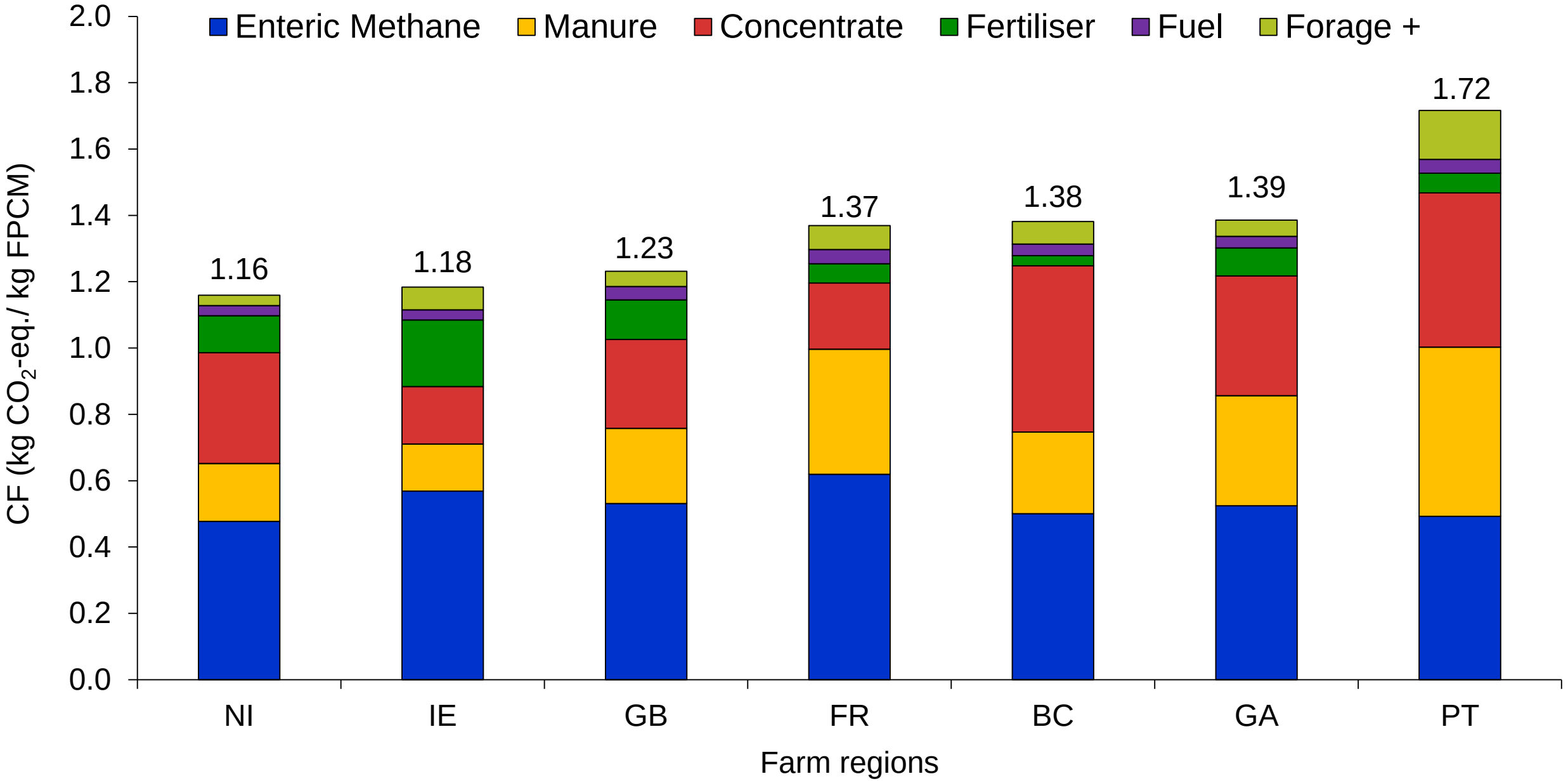
Milk yield, concentrates fed and grazing time



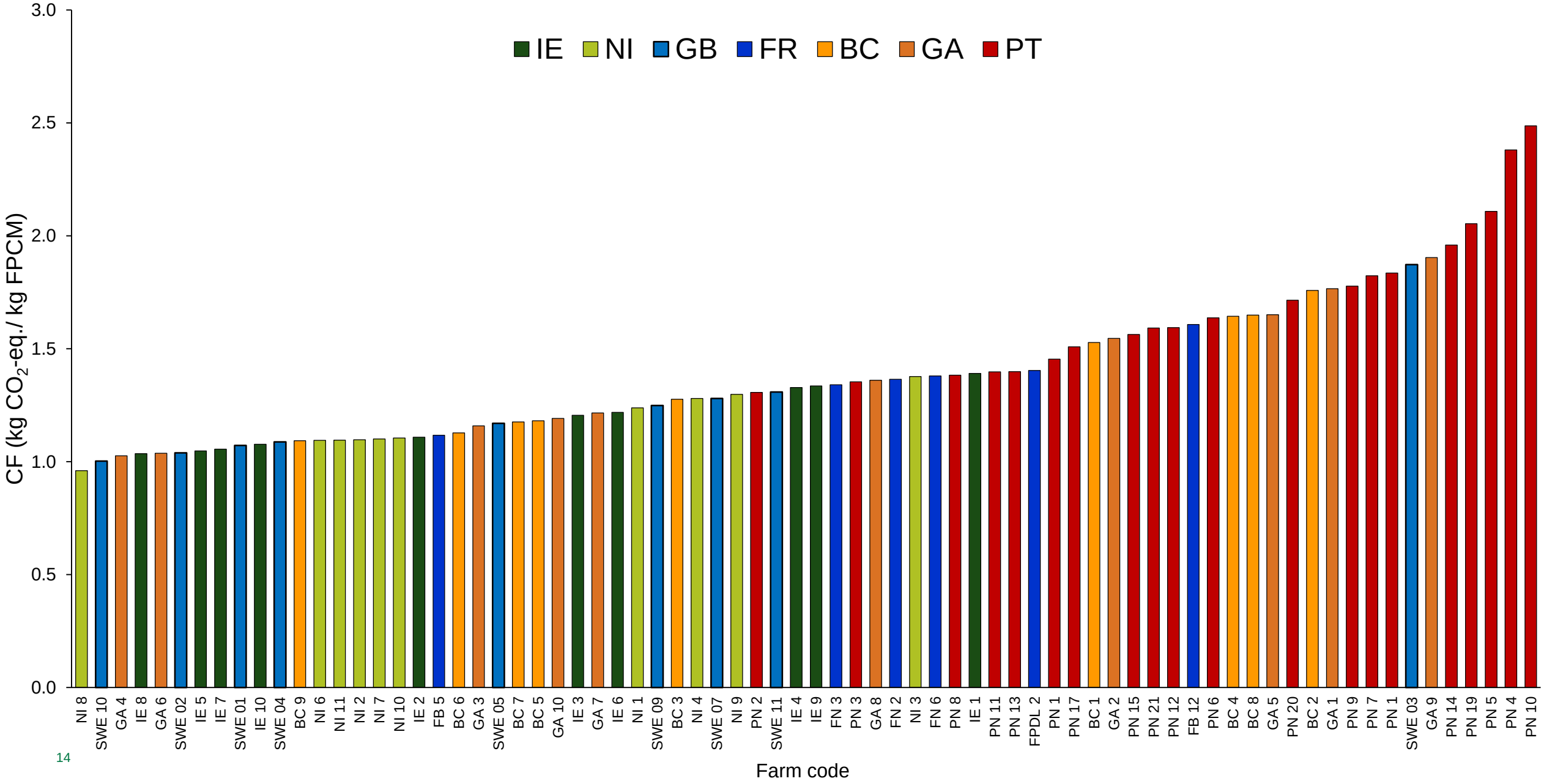
Farm Characteristics

	Grazing time (%)	Milk production (kg/cow)	Concentrate (kg DM/LU)	Purchased Forages (kg DM/LU)	Fertilizer N (kg/ha)
Ireland	66	488	966	421	270
N. Ireland	25	714	2,425	159	189
Great Britain	55	530	1,825	150	175
France	39	476	632	771	35
Galicia	17	677	2,466	466	80
Basque	5	759	3,561	1,150	45
Portugal	0	685	2,757	2,042	163

Carbon footprint per kg milk in the different regions



Carbon footprint per kg milk on the pilot dairy farms

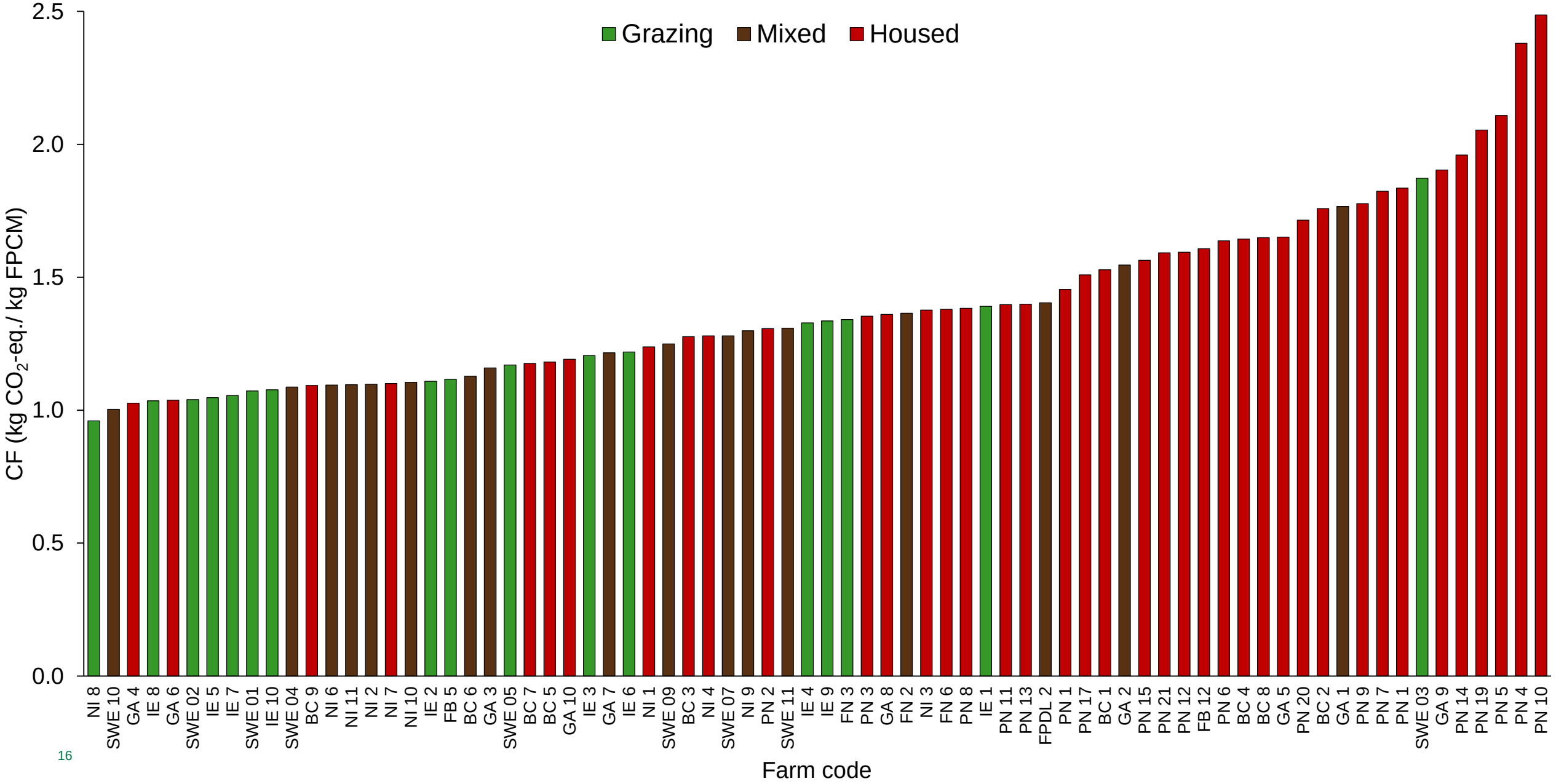


Farm systems

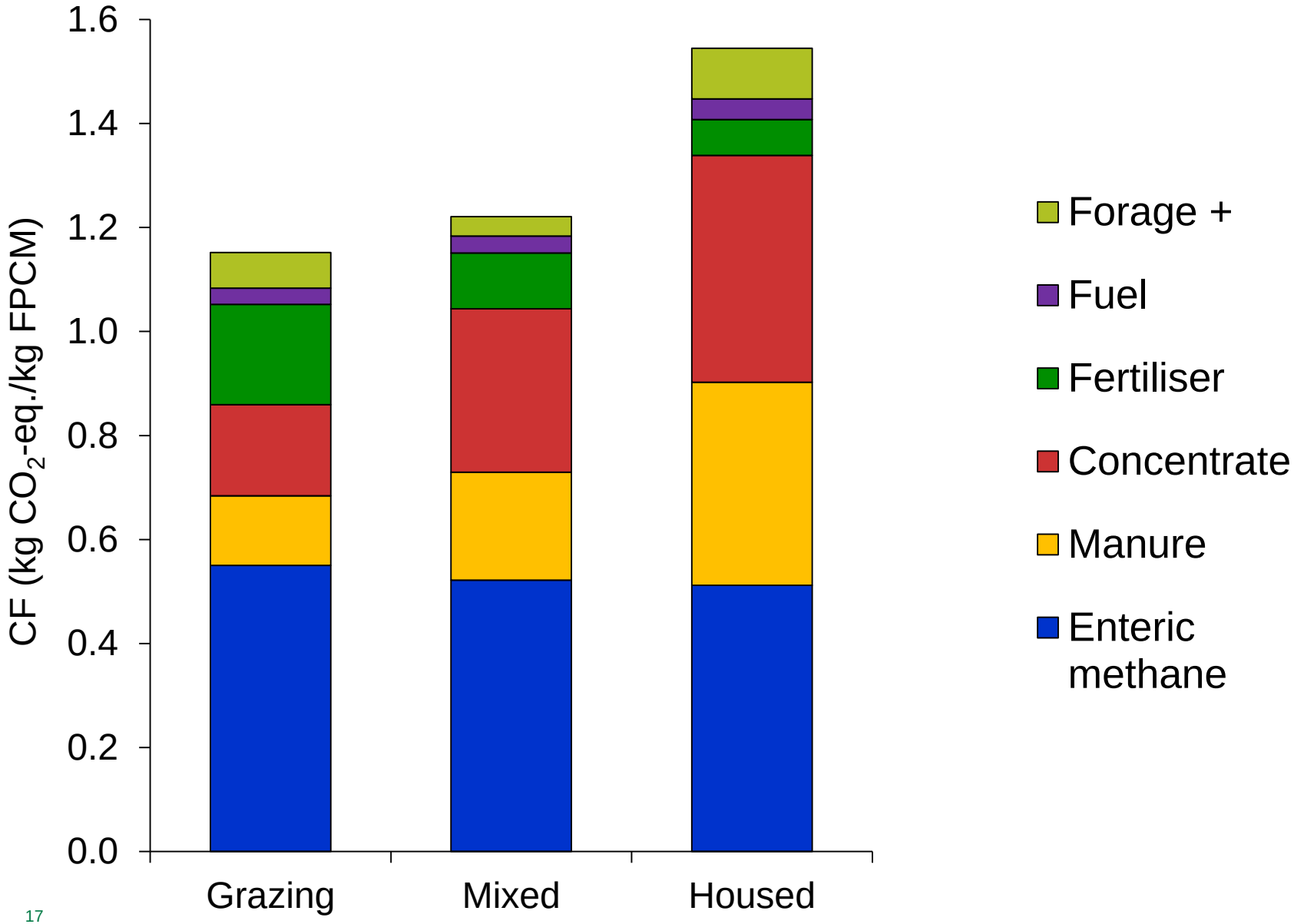
- **Grazing**: >60% grazing throughout the year
- **Housed**: 100% housed
- **Mixed**: <60% grazing & <100% housed

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

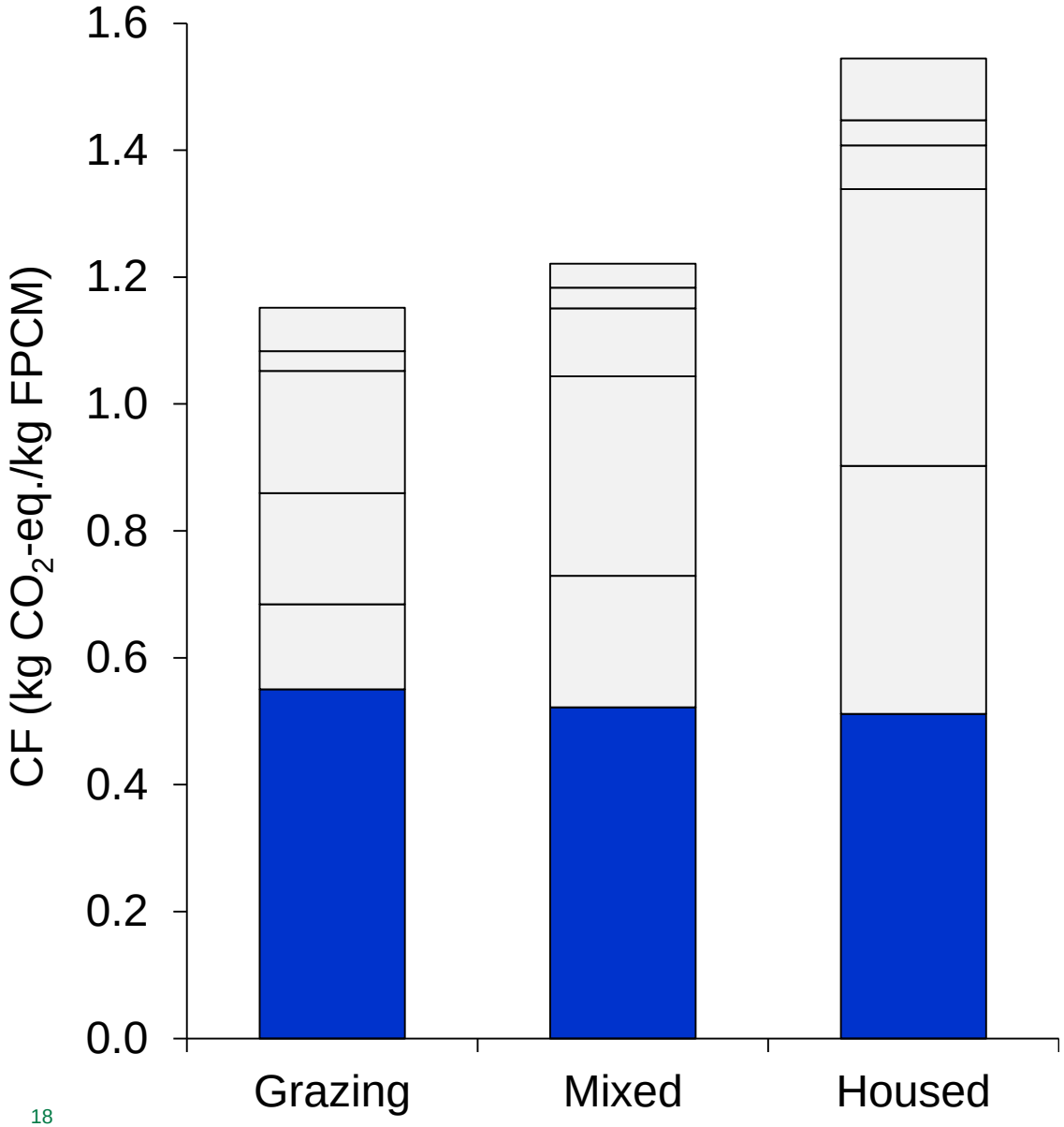
Carbon footprint per kg milk on the pilot dairy farms



Components of the carbon footprint of milk in different systems

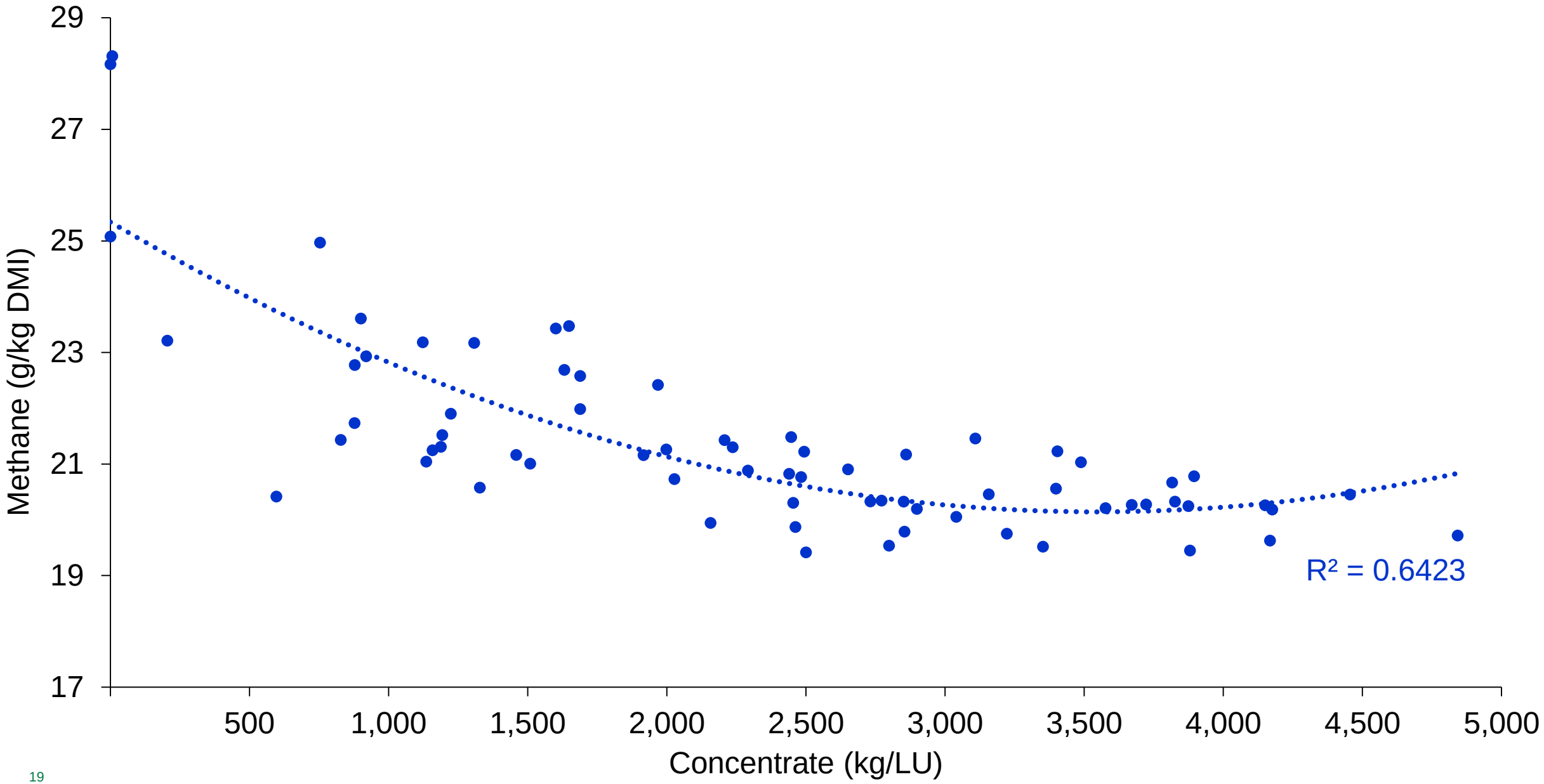


Methane emissions from different production systems

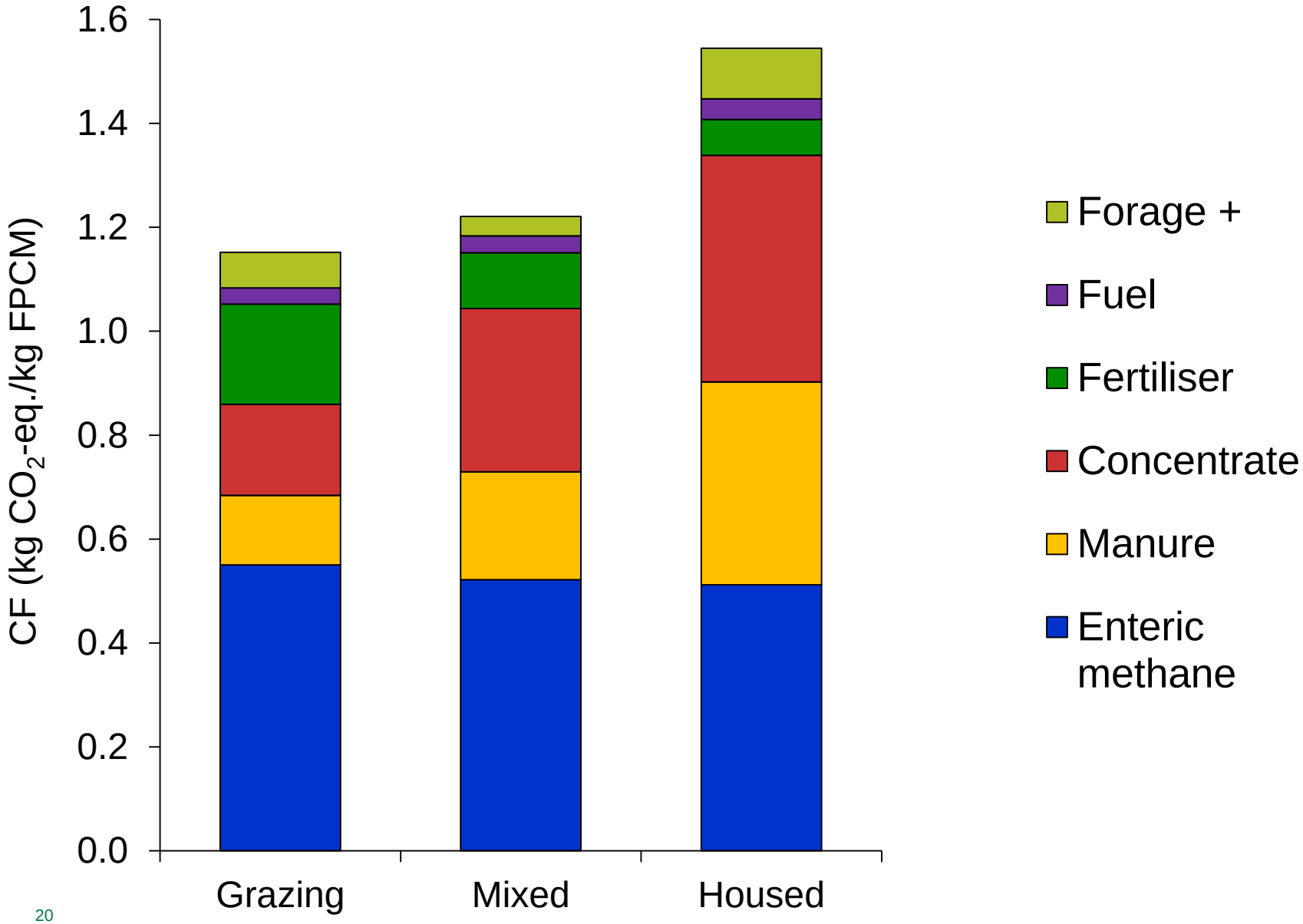


		Grazing	Mixed	Housed
Concentrate	kg/LU	837	2,016	2,937
Milk solids	kg/cow	437	623	723
Age at first calving	months	26	28	27
Replacement rate	%	23	28	30

The effect of concentrate on methane emissions per kg DM

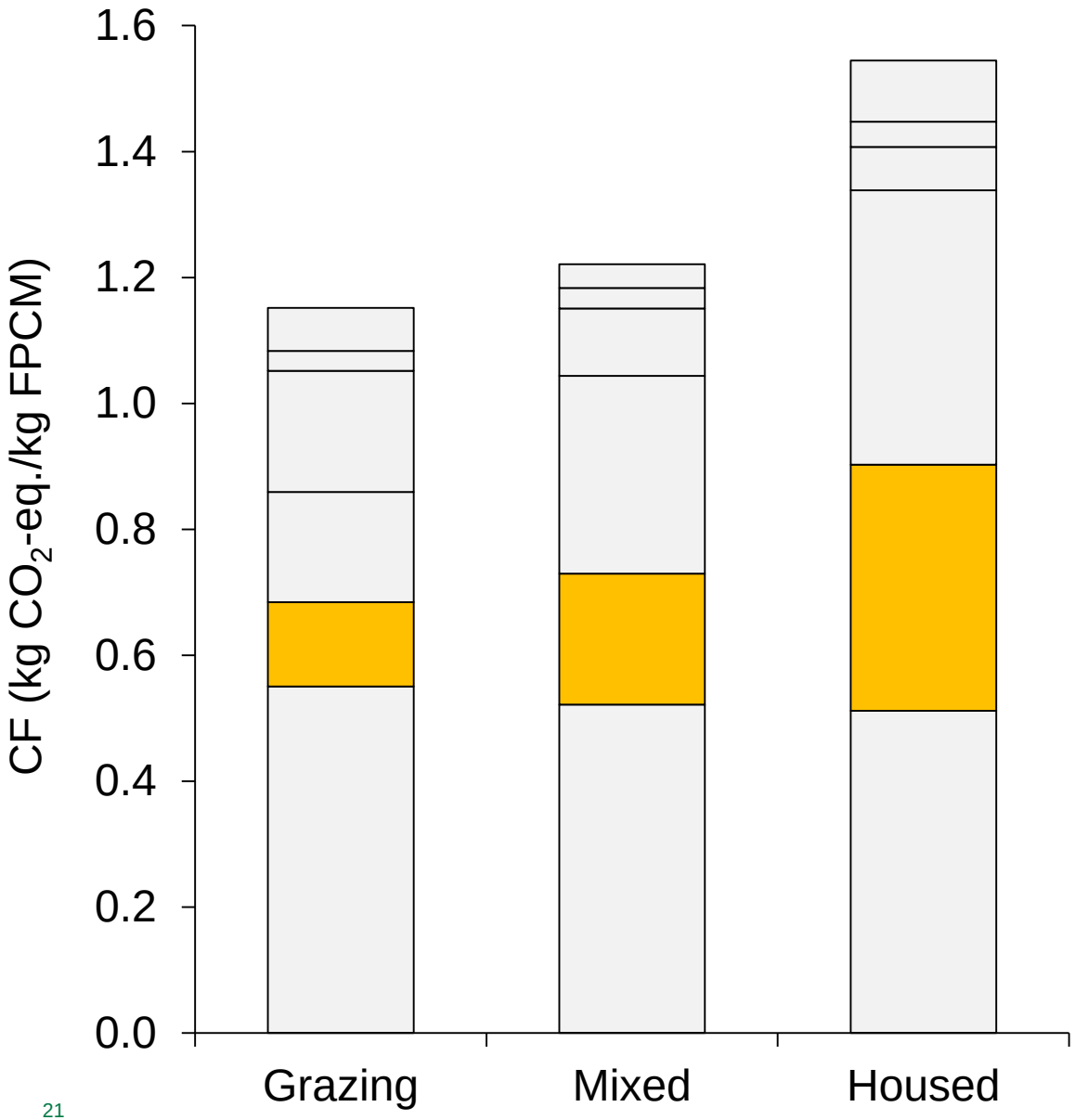


Carbon footprint of milk in different systems

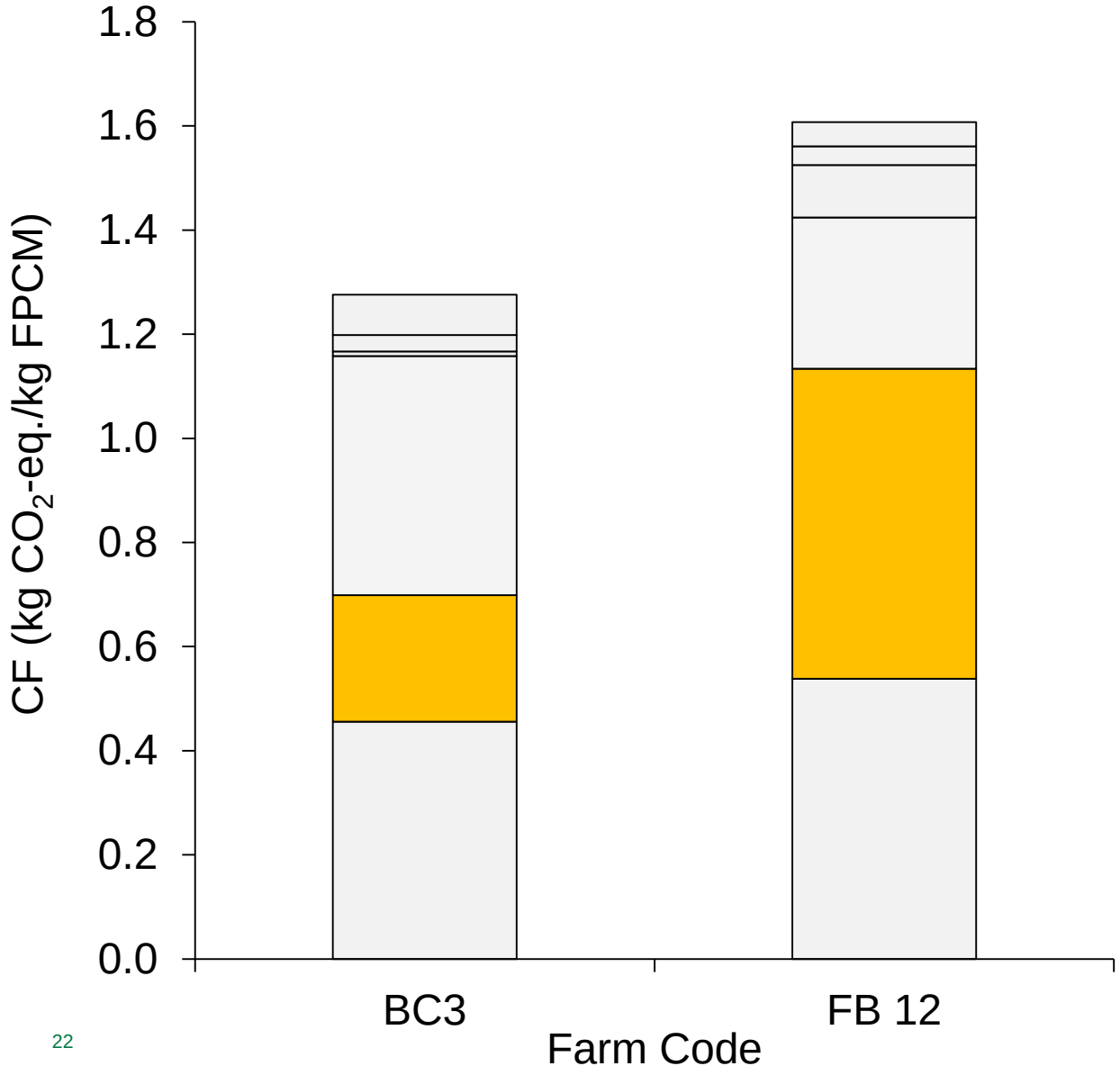


Agriculture and Food Development Authority

Emissions from manure management in the different systems

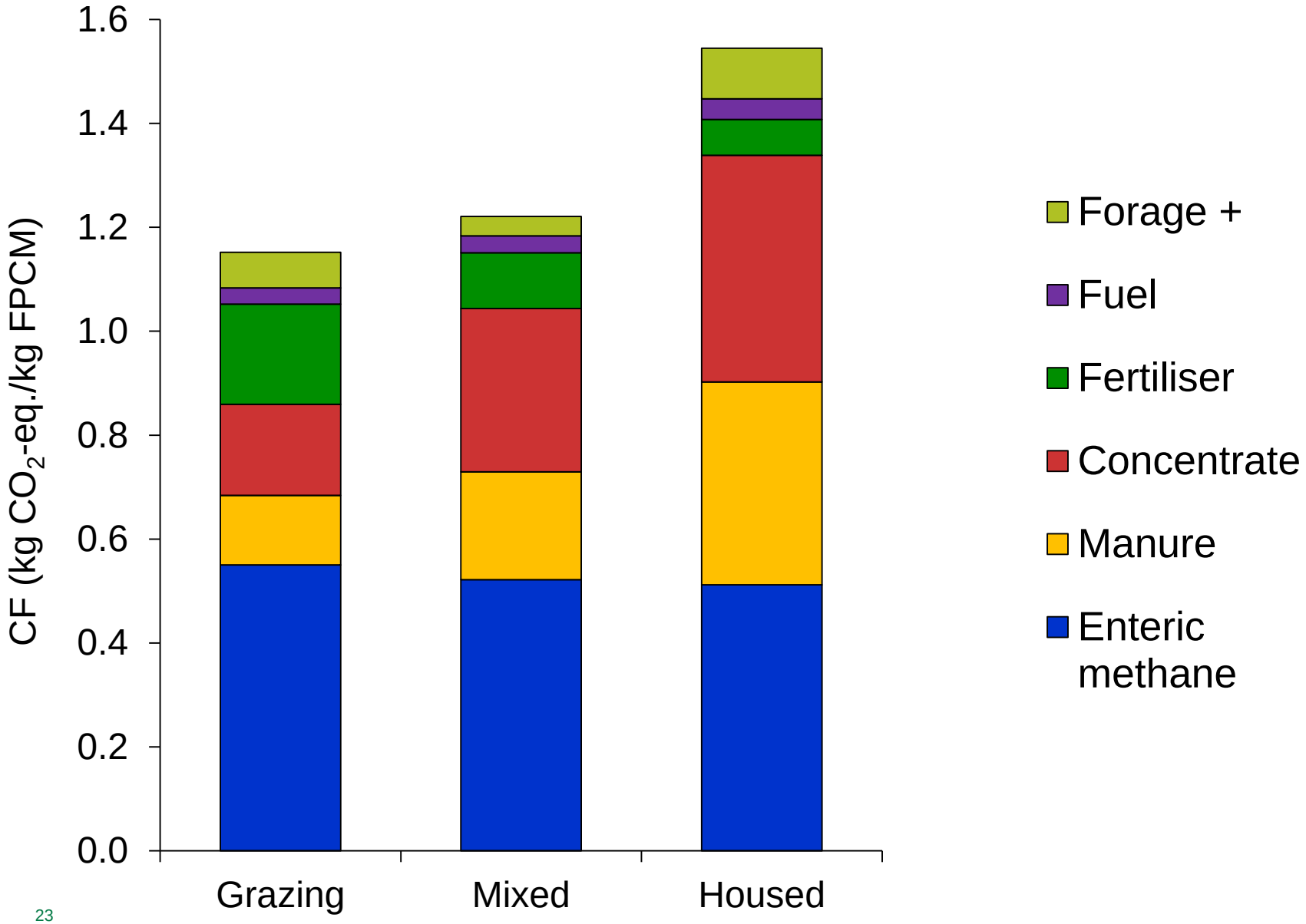


Emissions from covered vs uncovered slurry storage

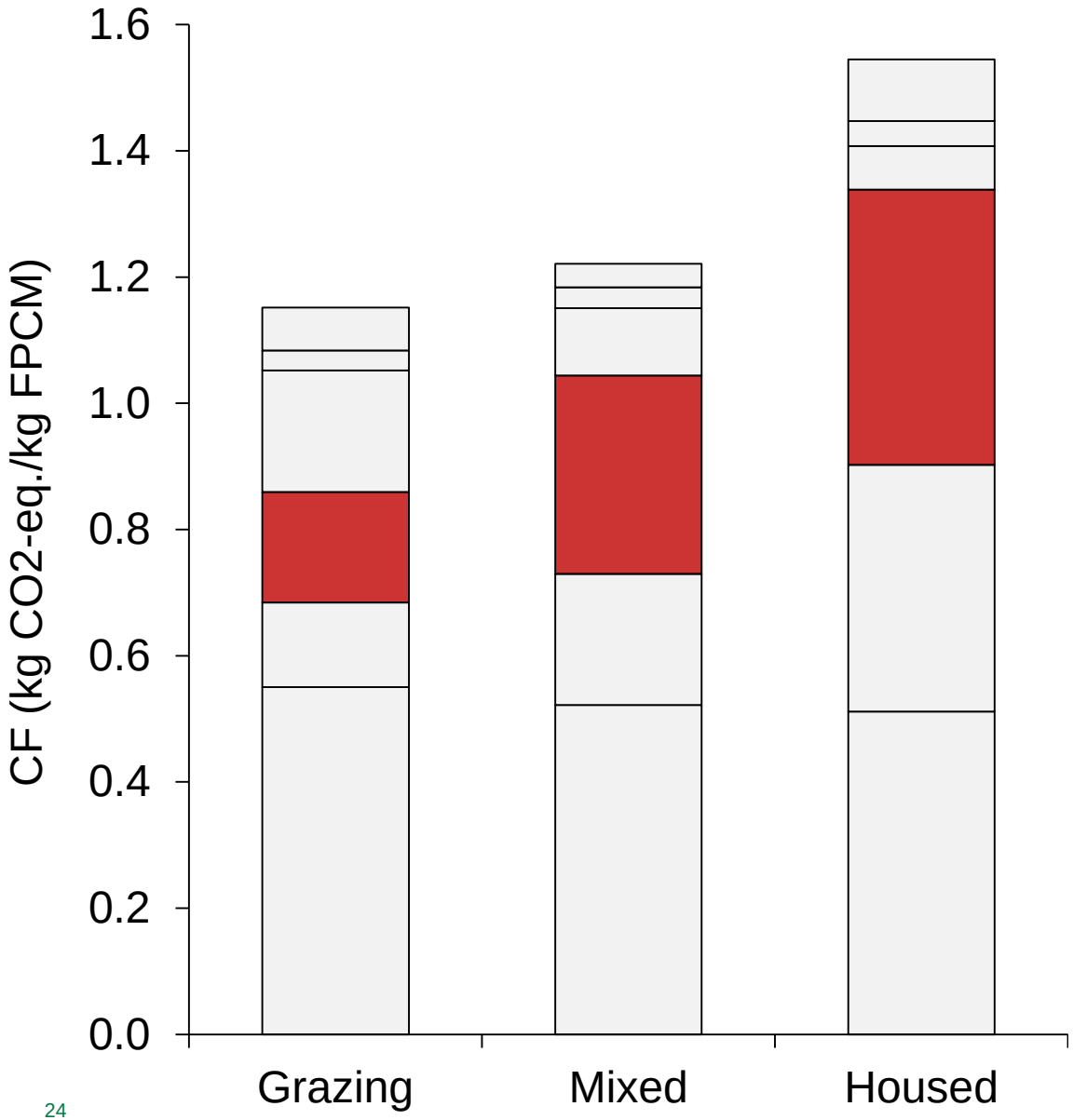


	BC 3	FB 12
Manure storage	Covered	Uncovered

Carbon footprint of milk in different systems

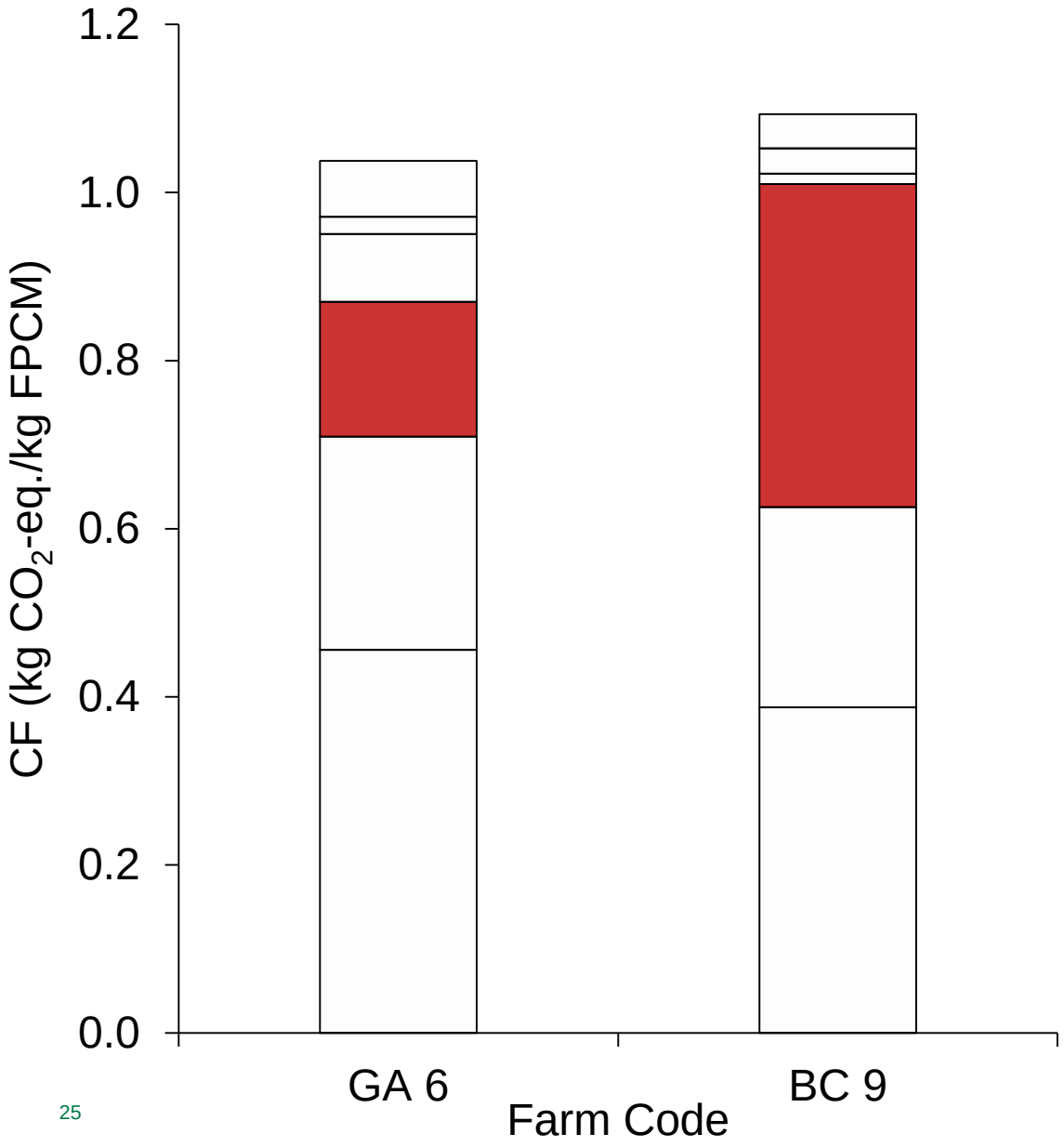


Emissions from concentrate fed



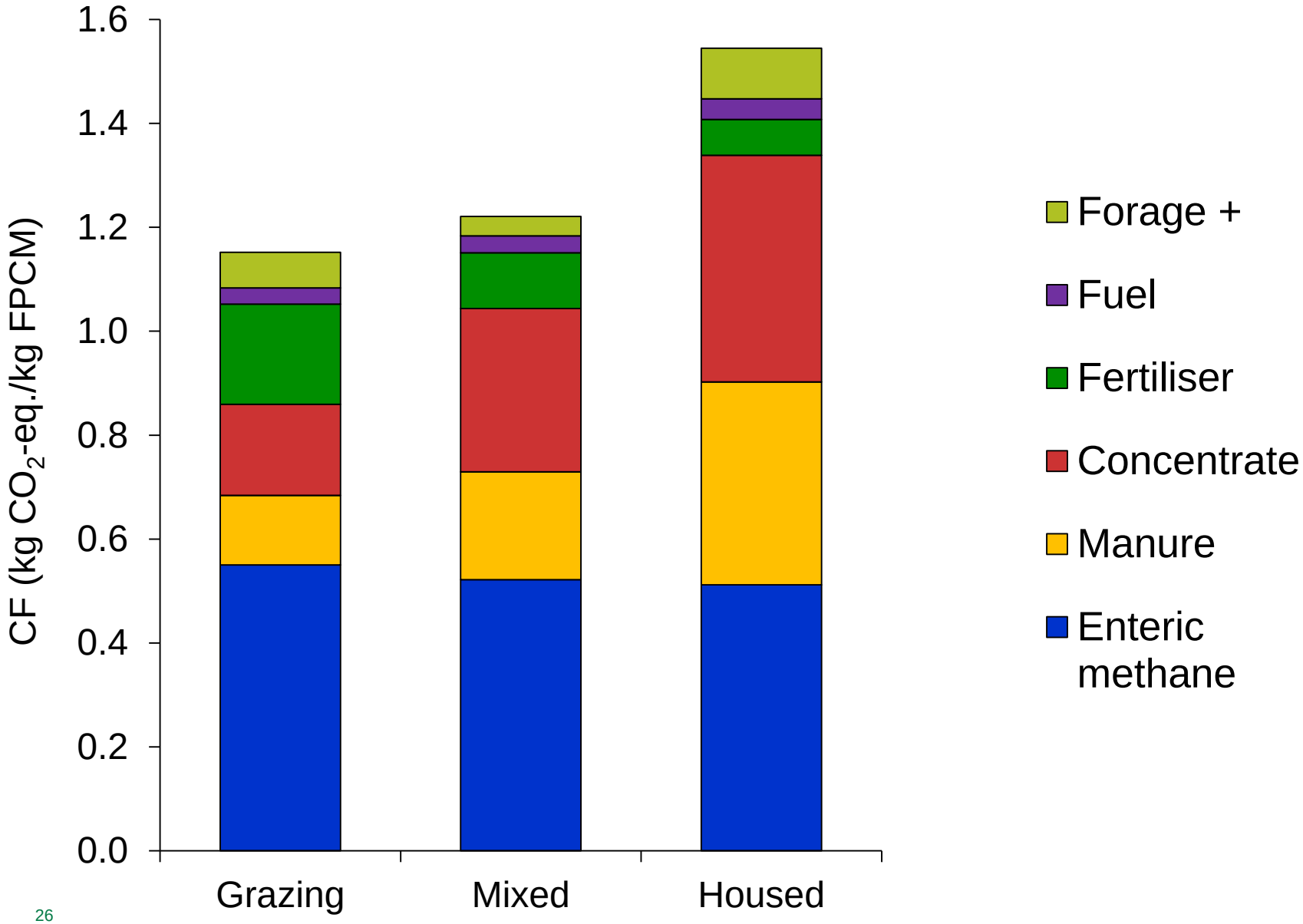
		Grazing	Mixed	Housed
Concentrate	kg/LU	837	2,016	2,937

Emissions from different concentrate types



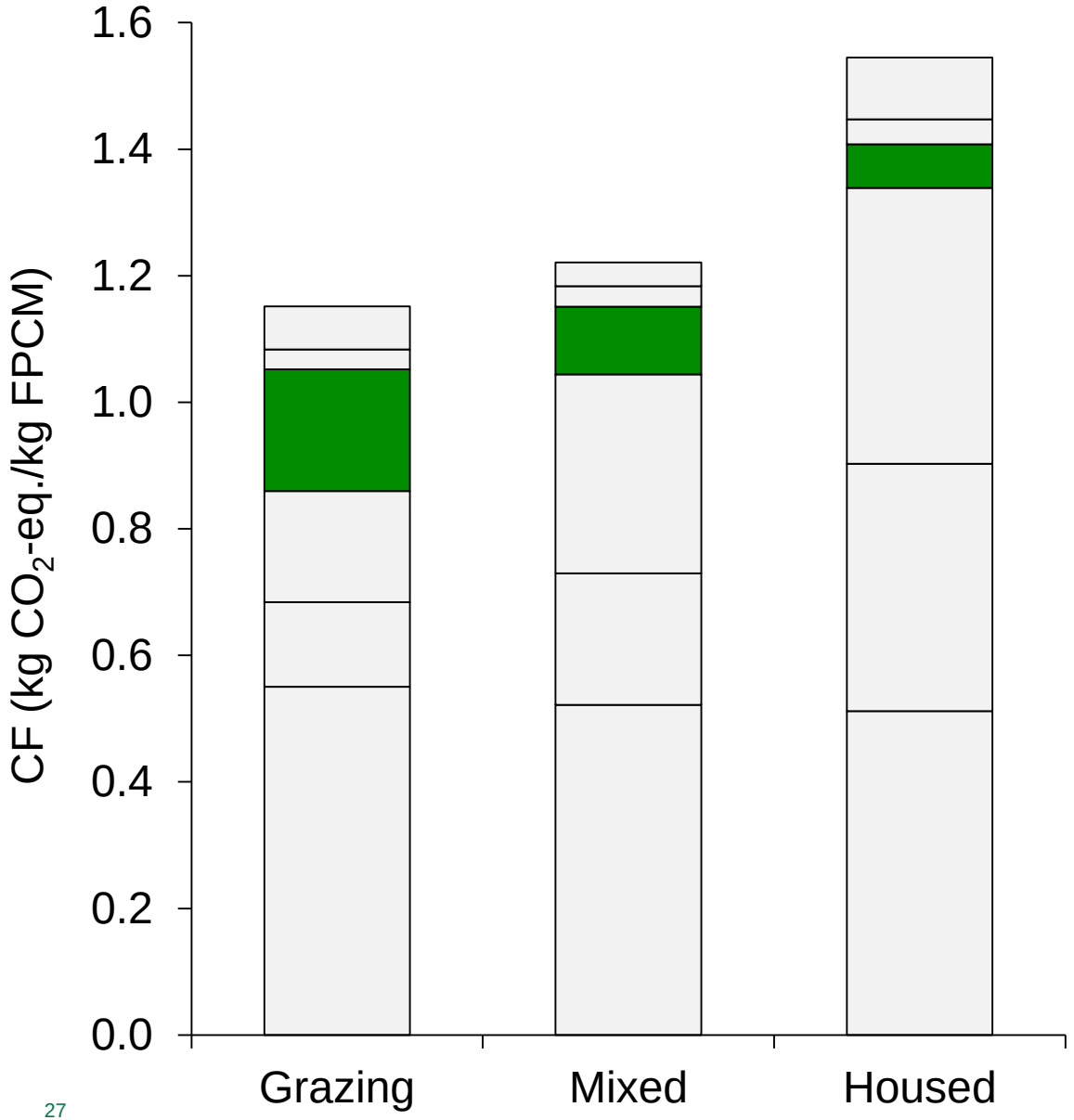
	GA 6	BC 9
Concentrate (t/LU)	5.4	3.8
Type	Locally produced low crude protein	Imported Soya

Carbon footprint of milk in different systems



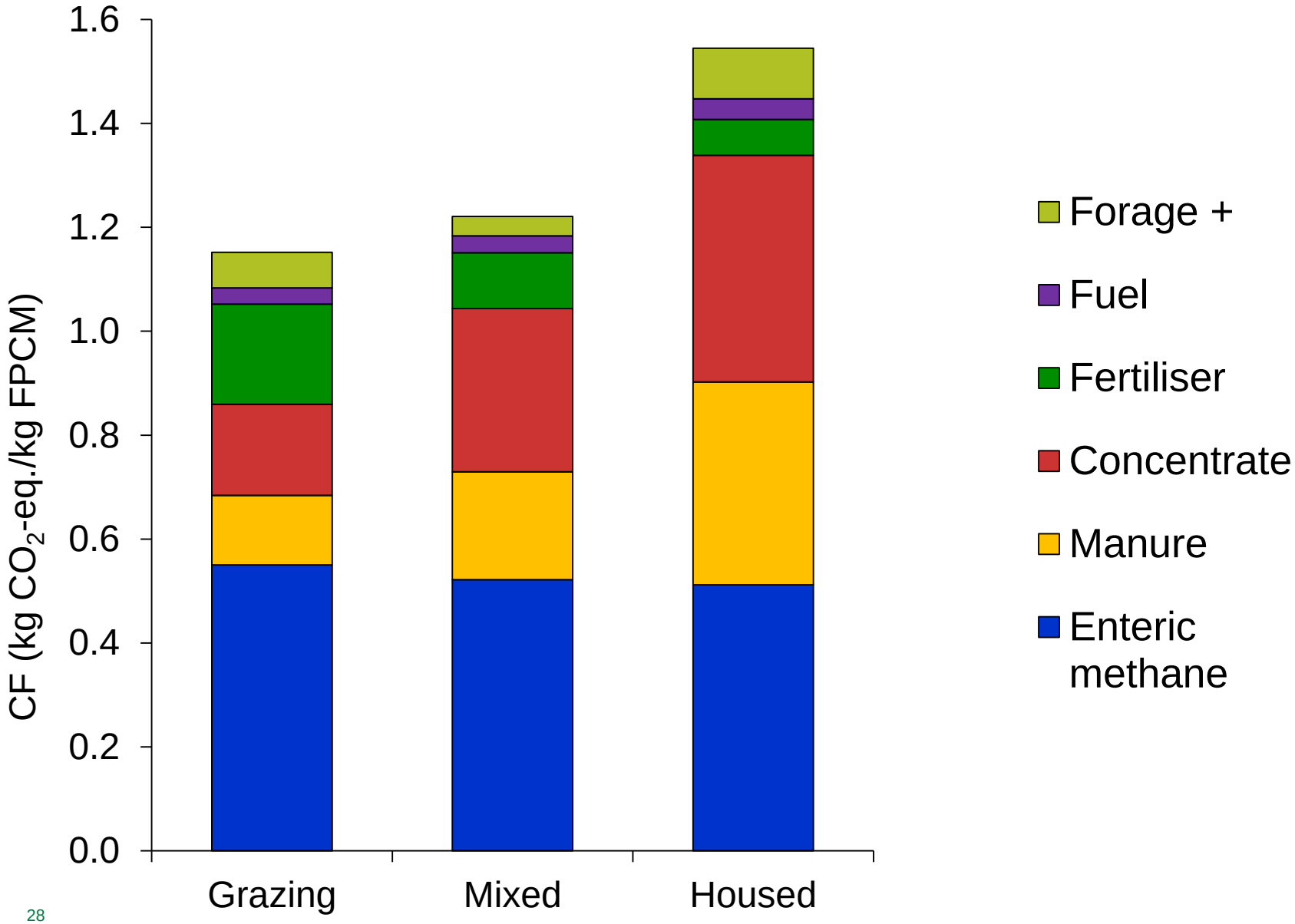
teagasc
Agriculture and Food Development Authority

Emissions from fertiliser N



	Grazing	Mixed	Housed
Fertiliser N kg/ha	247	161	130

Carbon footprint of milk in different systems



Agriculture and Food Development Authority

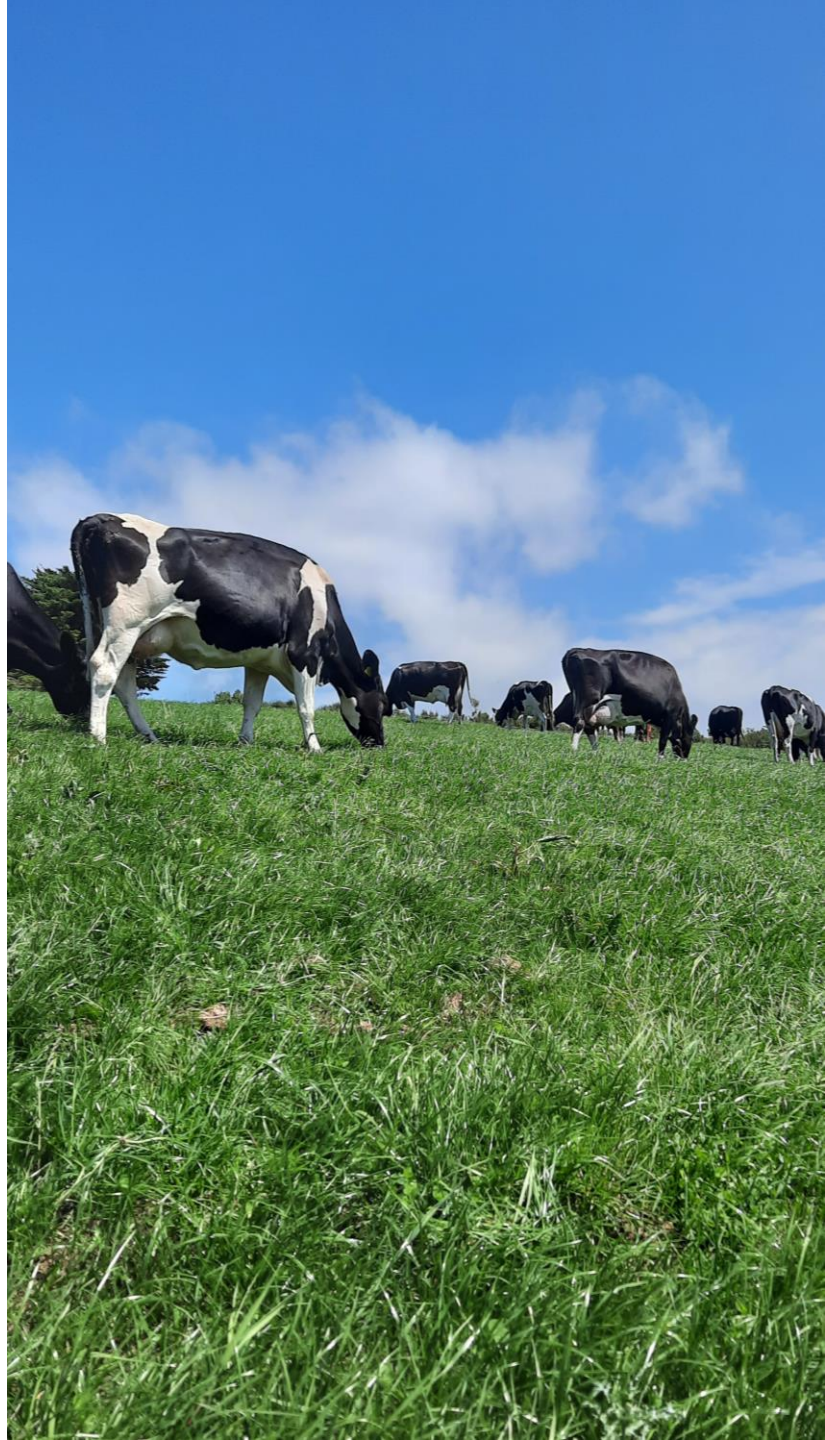
Summary

- Ambitious reduction targets set for Agriculture
- Big range of carbon footprints → Considerable potential for lowering emissions
- Fertiliser N use, manure management, concentrate use, enteric fermentation
- Pasture-based systems tend to have lower carbon footprints




Other aspects of the study

- Acidification
- Eutrophication
- Fossil fuel use
- Global land use
- Human edible feed conversion efficiency (heFCE)
- Economic impact
- Social impact



Acknowledgements

James Humphreys
Imelda Casey
David Styles
Edward Burgess
Andre Le Gall
Sylvain Foray
Pilar Merino
Oscar Del Heriro
Cesar Resch Zafra
Henrique Trindade
Martin Mulholland
Aidan Cushnahan
Robert Patterson

Stephen Roderick
Martina Dorigo
David Fangueiro
Maggie March

Aubin Lebrun
Tanguy Bodin
Nadine Abgrall
Hartiz Arriaga
Eduardo Rosa Gonzalez
Valentín García Souto

José Carlos Marques de Almeida
Severiano José Cruz da Rocha e Silva
Linda Lawrance
Ana Fernandes
Paul Hargreaves
Henrietta Fox
Mark Boland
Oisín Coakley
Kevin Madden