Characterization of environmental impact of 10 000 French dairy farm

Evolution and mitigation measures

Rémi VIAL
French Livestock Institute – IDELE

Rémi VIAL[1], Alisson STOCCHETTI[1], Catherine BROCAS[1]
1 - IDELE

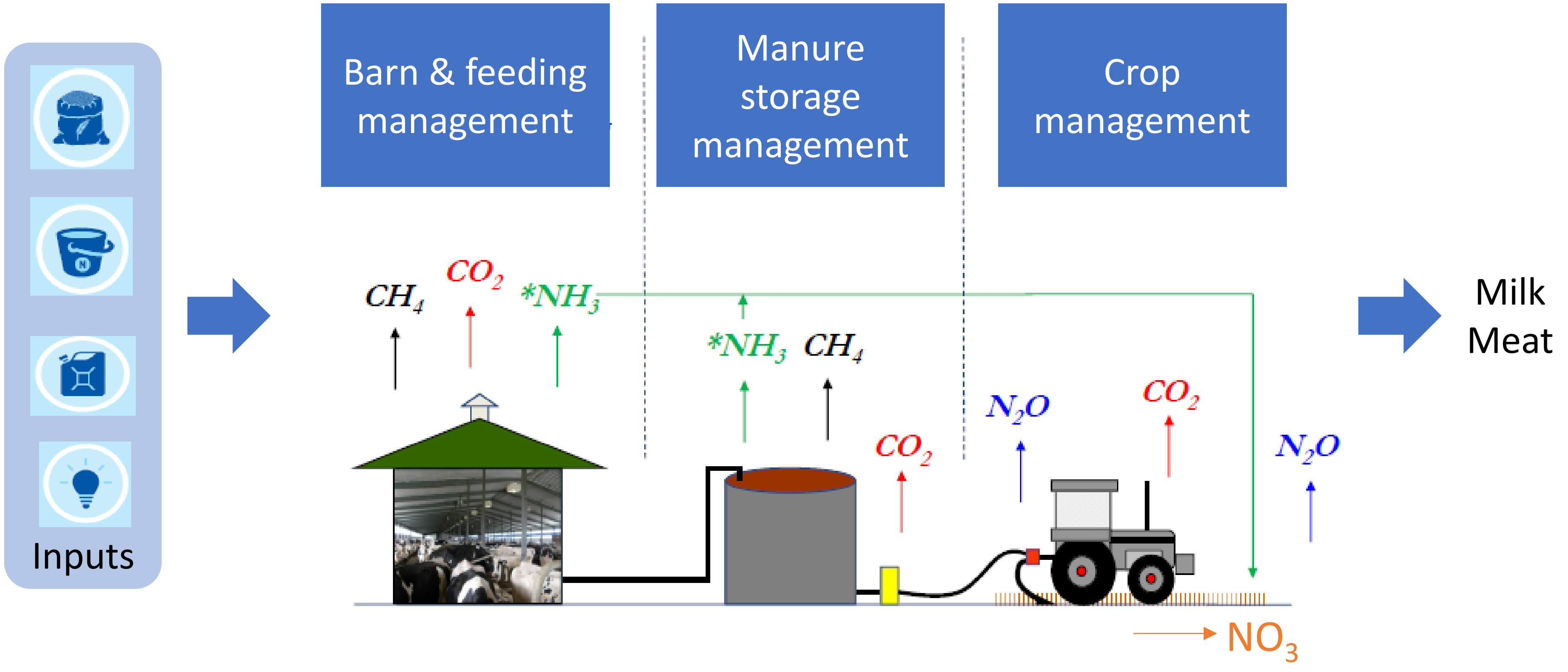
Introduction : CAP’2ER® tool

- First goal : Understanding the GHG emission hotspots to prioritize emissions mitigation option on farm.
- The environmental performance is assessed with the Life Cycle Analysis methodology.
- Carbon footprint is based on international standard (IPCC-2006, tiers 3, FAO-2016 IDF 2010)
- It include milk carbon footprint and other environmental impact categories and positives contributions.

Systems covered	DAIRY CATTLE	BEEF CATTLE	DAIRY SHEEP	MEAT SHEEP	GOATS	PIGS*	POULTRY*	FIELD CROPS
Environnemental impact	Climate change	Fossil Energy use	Nitrogen balance	Emission of ammonia				
Positive contribution	People fed	Carbon sequestration	Biodiversity					
Durability (optional data)	Milk Production cost	Working condition						

GHG emissions scope

CAP'2ER®



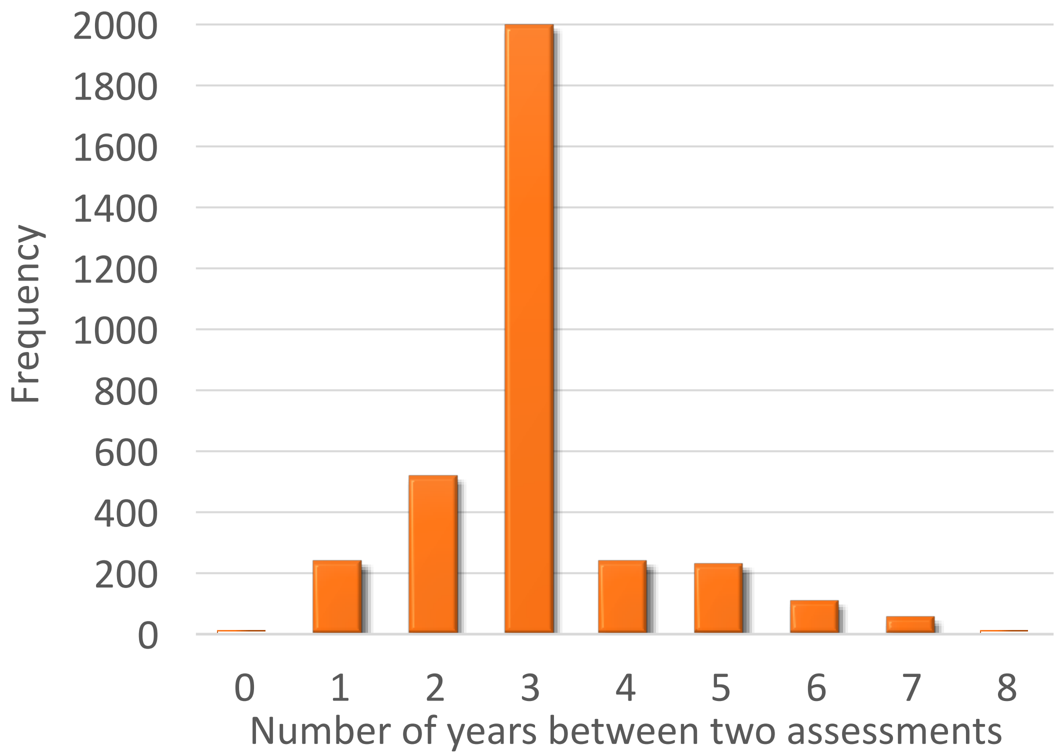
Sample presentation

13 053 assessments of **9 875** dairy farms

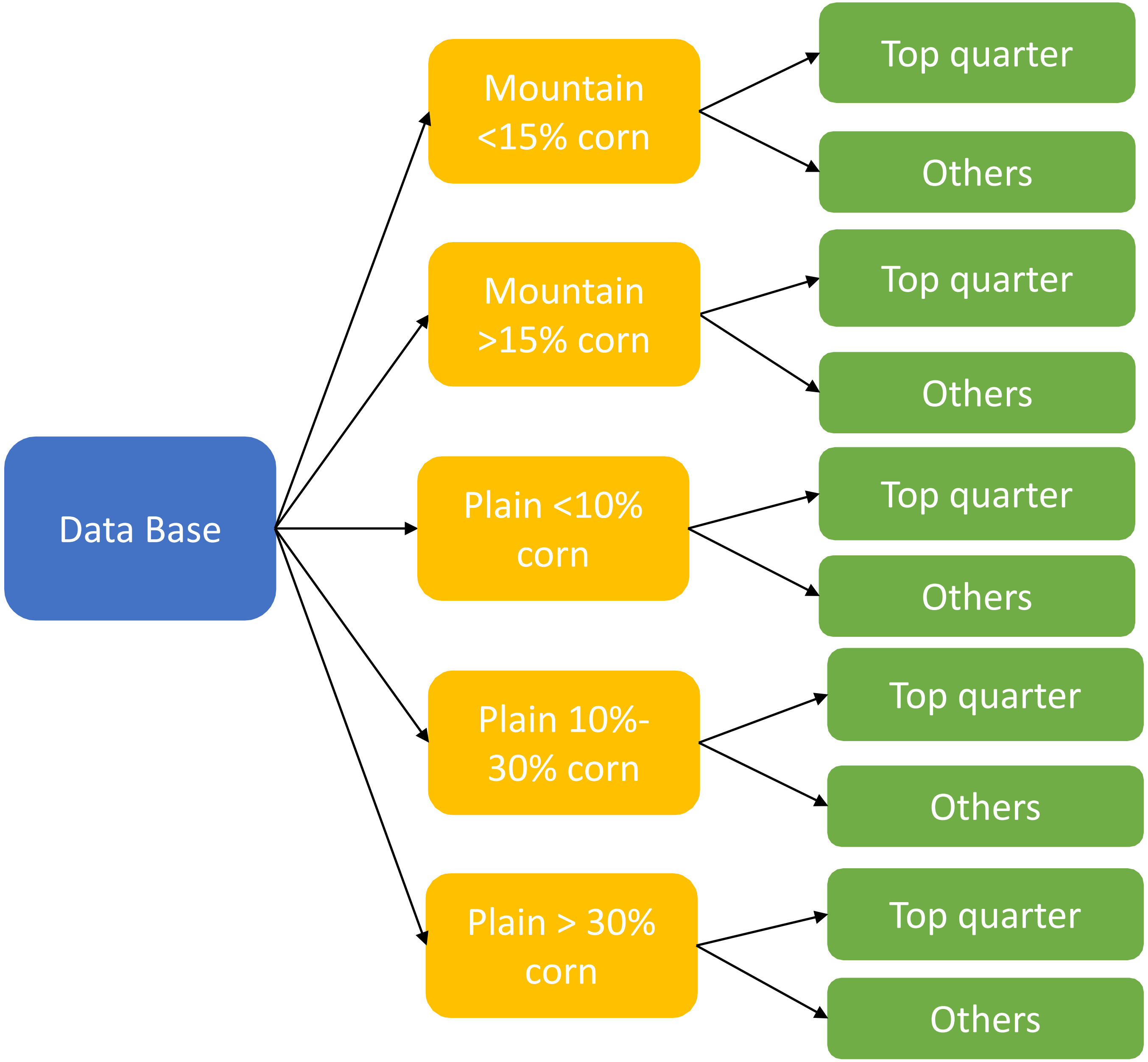
- Number of dairy cows : **13** to **335** (average : **74**)
- Total cultivated area : **17** to **753** ha (average : **118** ha)

2 810 farms carried out at least 2 assessments:

- **2 466** farms with 2 assessments
- **323** farms with 3 assessments
- **18** farms with 4 assessments
- **3** farms with 5 assessments



Characterization of dairy farms with the lowest GHG emissions per liter milk



Package *FactoMineR*
Fonction *catdes*

Sample presentation

Characterization of dairy farms with the lowest GHG emissions per liter corrected milk

For all systems :

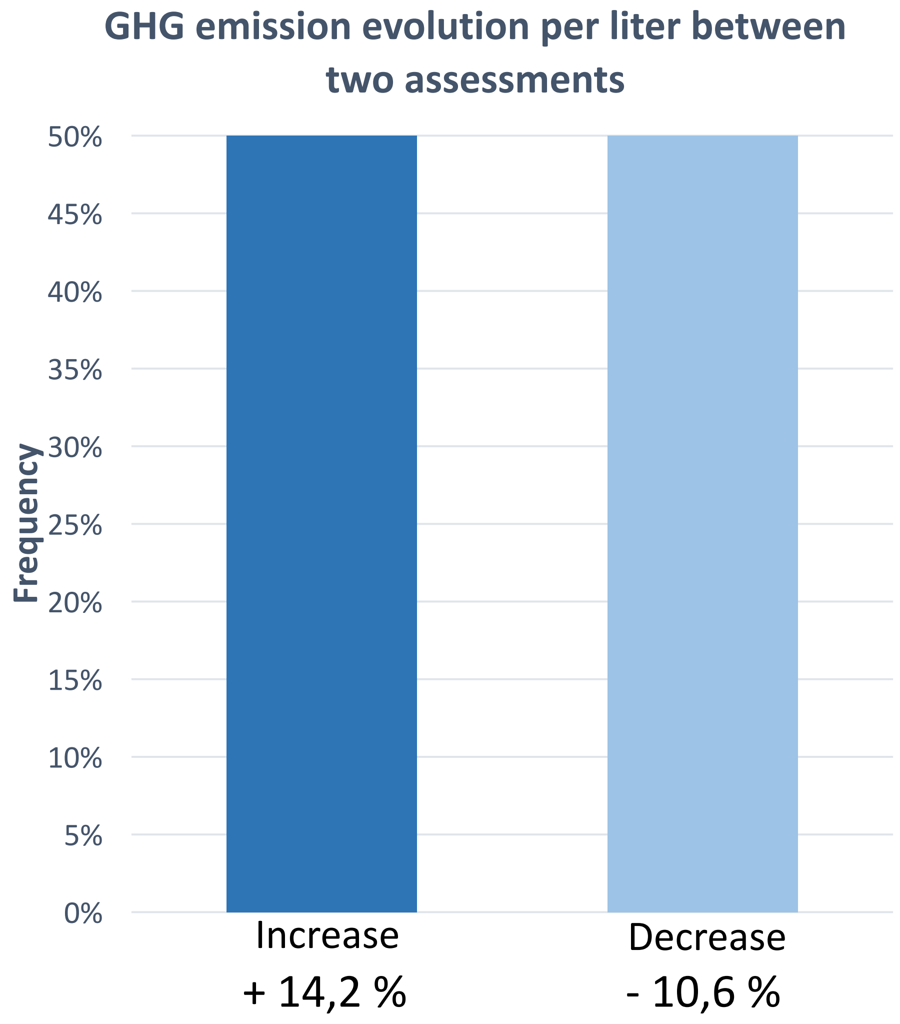
- Higher milk yield per cow
- Earlier age at first calving
- Higher protein autonomy

	System plain > 30% corn		
	Top quarter average	Sample average	p-value
GHG emission / L (kg eq CO2 / L)	0,851	0,975	
Milk yield (L/cow)	8 479	7 976	$6,9^{e}-132$
Age at first calving (Month)	27,5	28,6	$1,3^{e}-91$
Protein autonomy (%)	64	62	$1,3^{e}-38$
Concentrate distributed (g/L) *	163	177	$1,9^{e}-40$
Quantity of mineral nitrogen applied (kg N/ha) *	70	82	$2,0^{e}-70$

** Non-significant difference for all systems*

GHG emission evolution, first overview

On average, little evolution between two assessments :



Significant differences between the two groups :

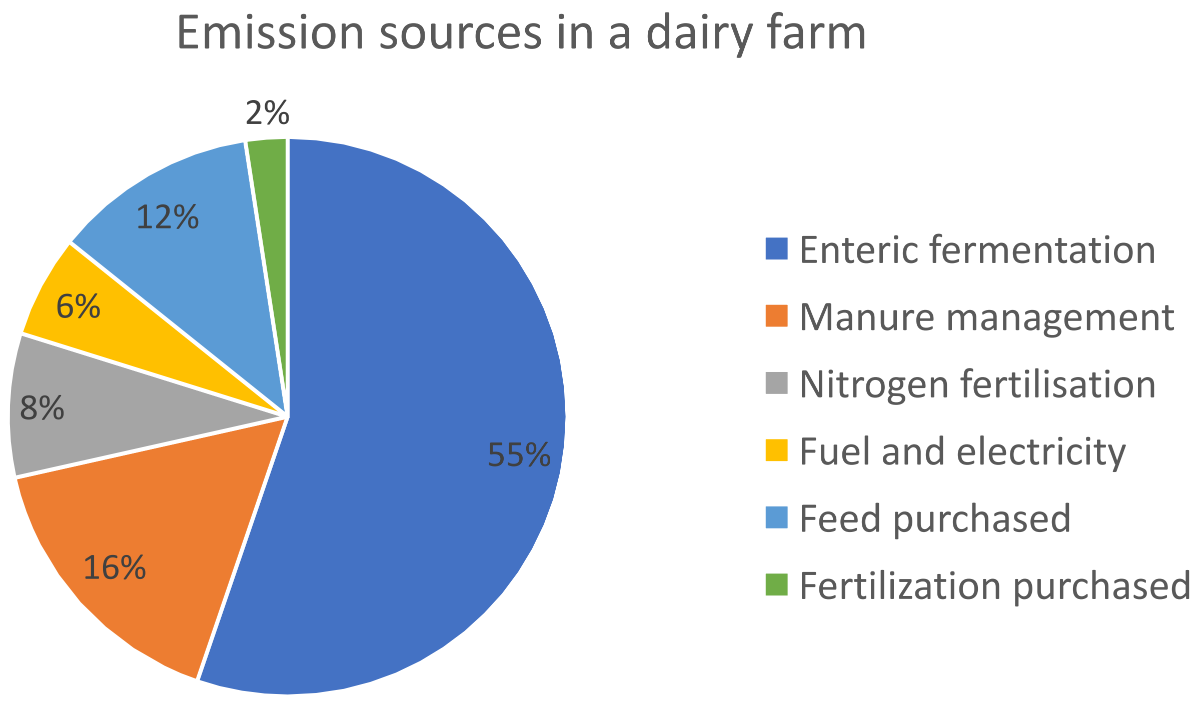
	GHG emission per liter		
	Average Increasing	Average Decreasing	P-values
Milk yield per cow	-2,5%	2,1%	2,2^{e}-16
Protein autonomy	-3,7%	2,3%	2,2^{e}-16

Impact of milk yield on the results

As expected, GHG emission are very linked to milk yield

→ Mainly due to the functional unit chosen to express the results (/ liter milk)

→ Dilution effect of the milk production.

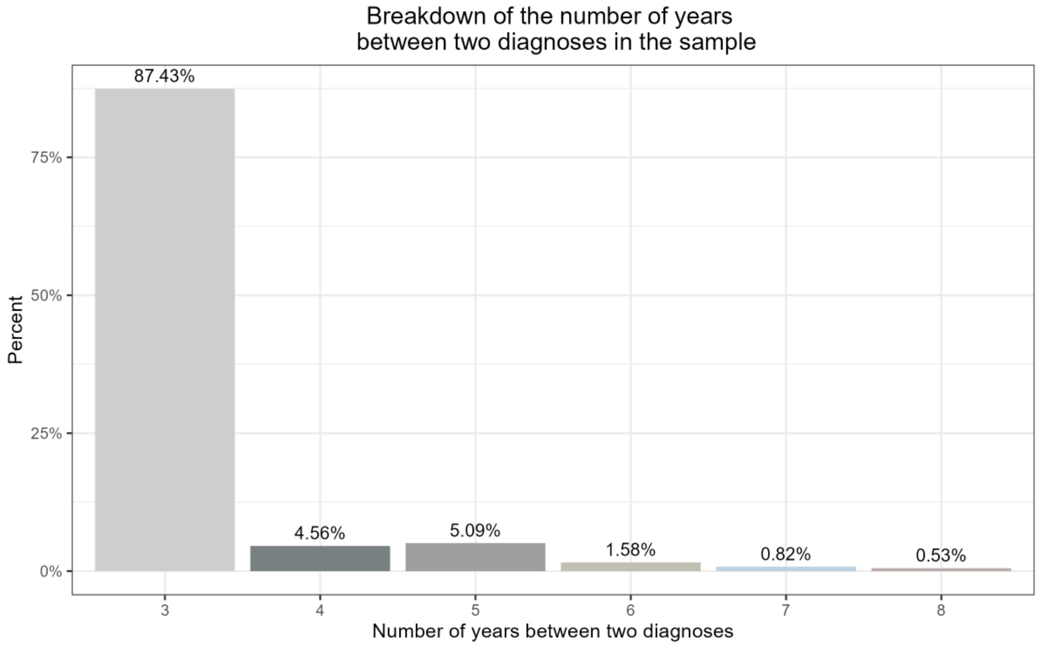


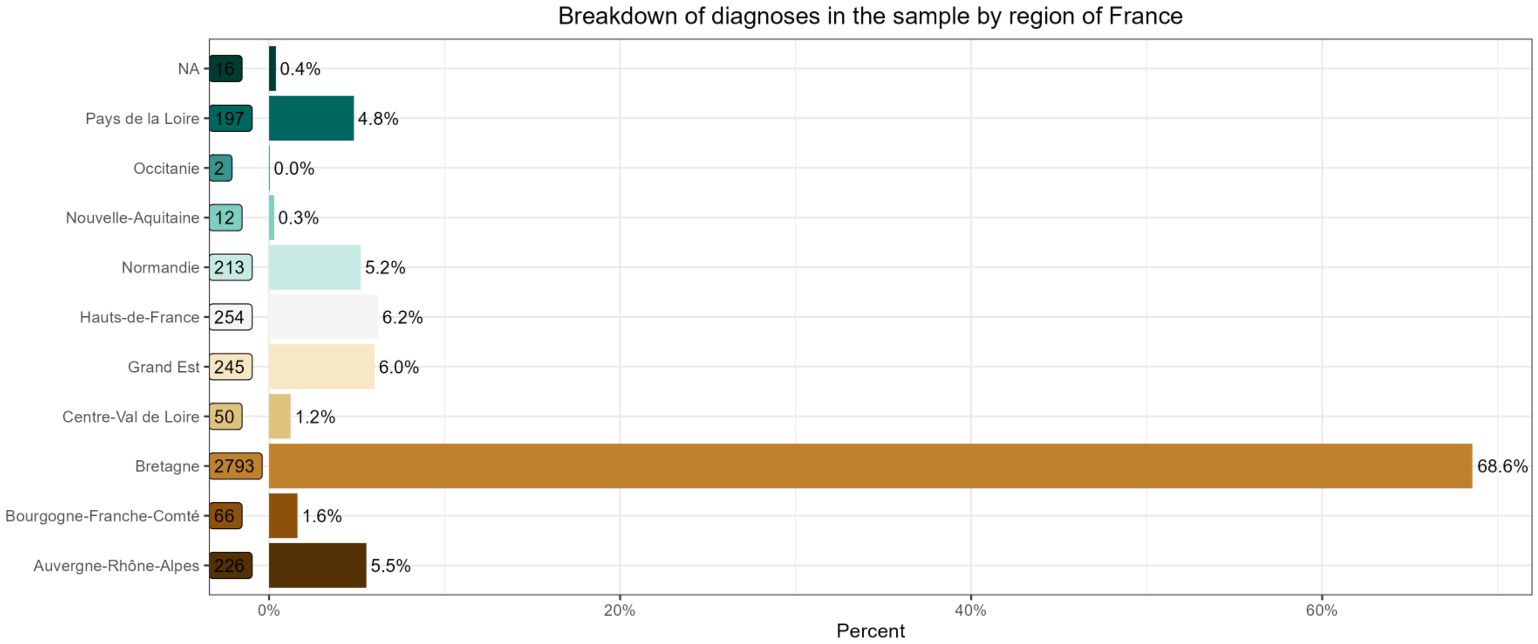
GHG emission evolution

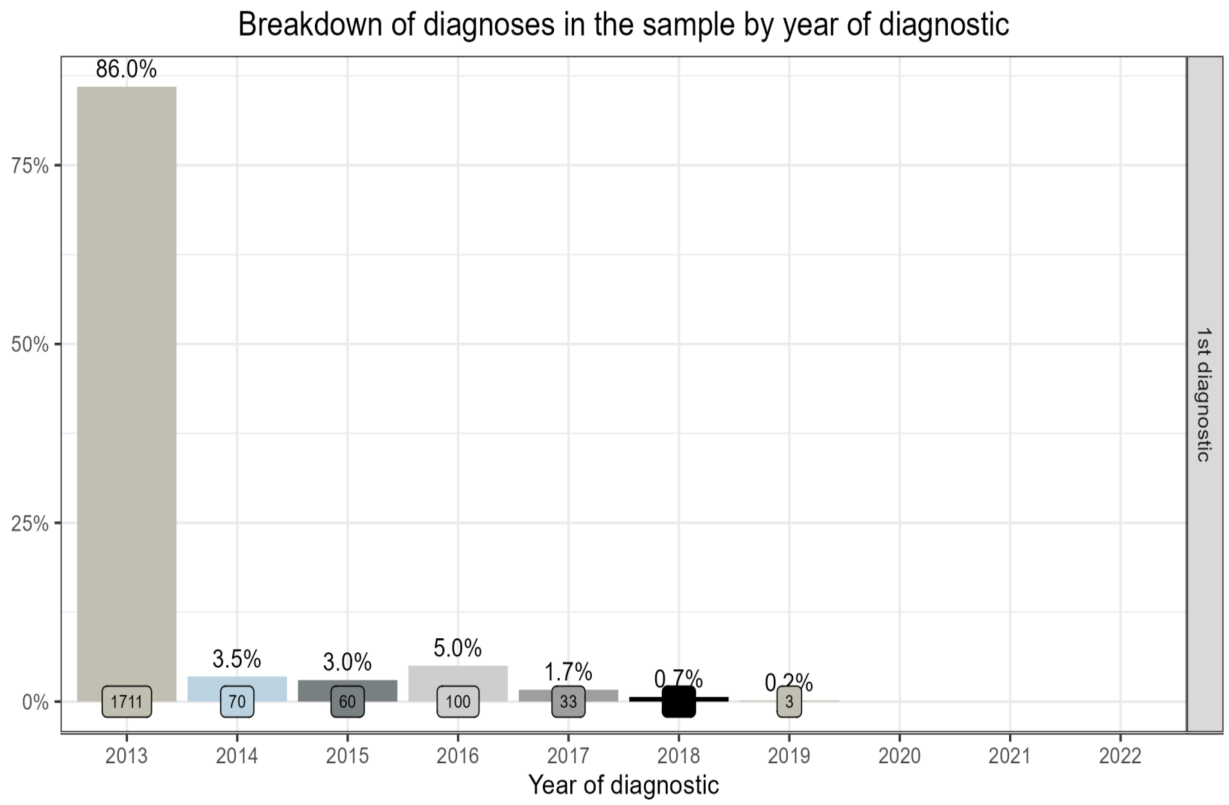
Data selection, between two assessments :

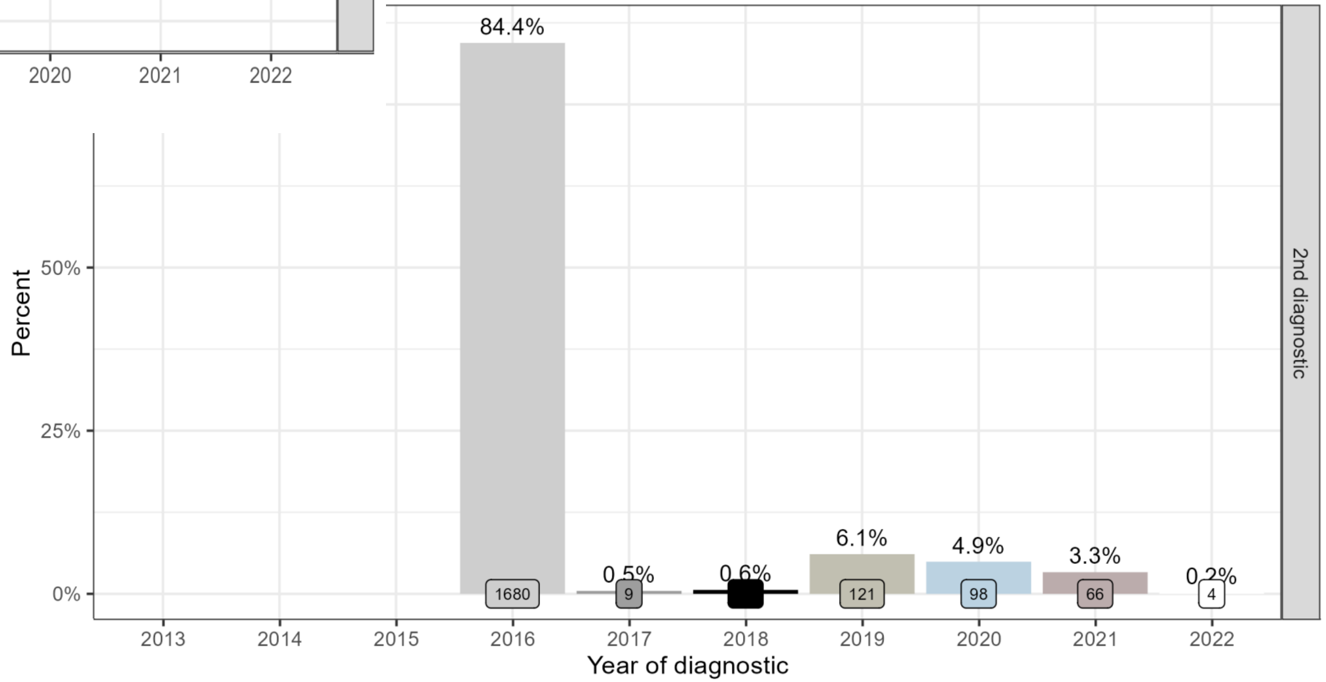
- At least 3 years
- With the same advisory organisation

→ Remains : 1990 farms between 2013 et 2022






Breakdown of diagnoses in the sample by year of diagnostic
86.0%
3.5%
3.0%
5.0%
1.7%
0.7%
0.2%
1711
70
60
100
33
3
75%
50%
25%
0%
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Year of diagnostic
1st diagnostic

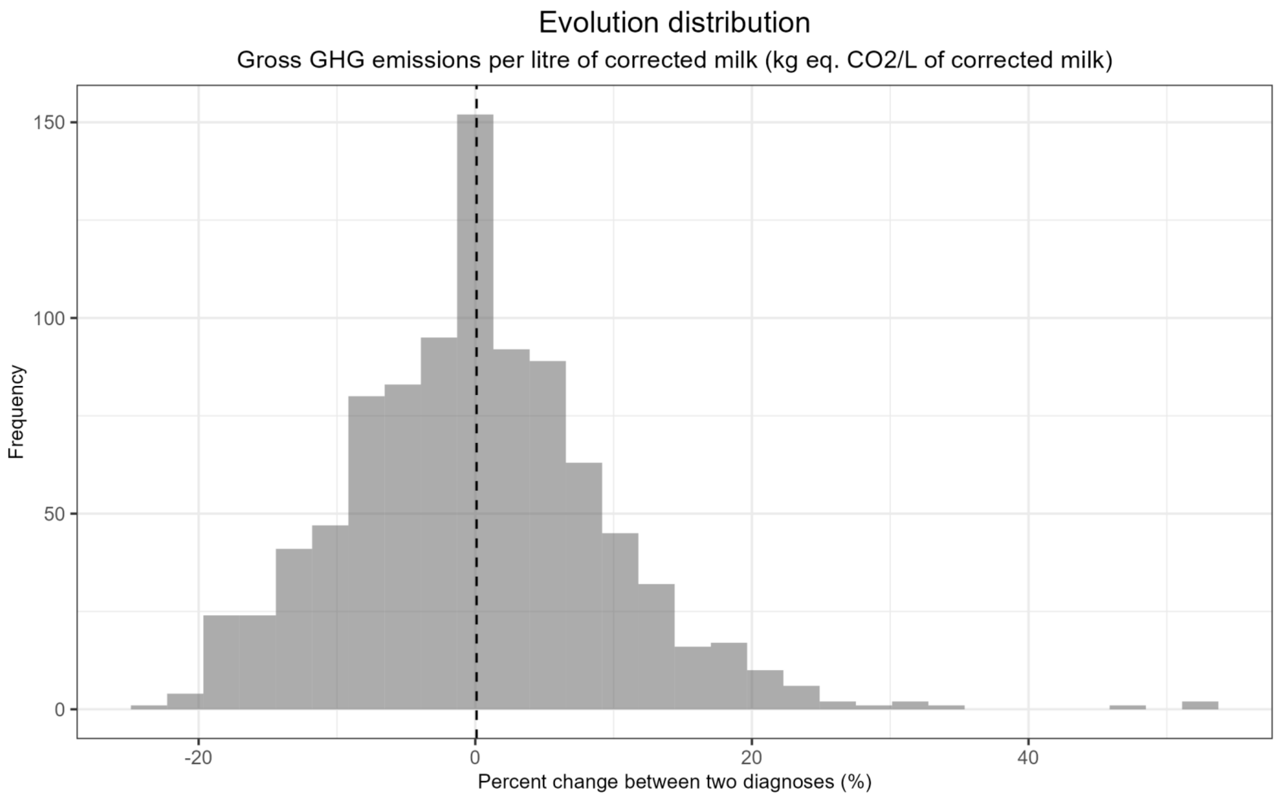

84.4%
0.5%
0.6%
6.1%
4.9%
3.3%
0.2%
1680
9
121
98
66
4
Percent
50%
25%
0%
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Year of diagnostic
2nd diagnostic

GHG emission evolution with a stable milk yield

Data sorting = Maximum evolution of the milk yield of +/- 5% between two assessments

→ **930 farms remain**

n	min	q1	median	mean	q3	max	sd
930	-23.8	-6.2	0	0.095	5.4	52.2	9.496



GHG evolution with a stable milk yield

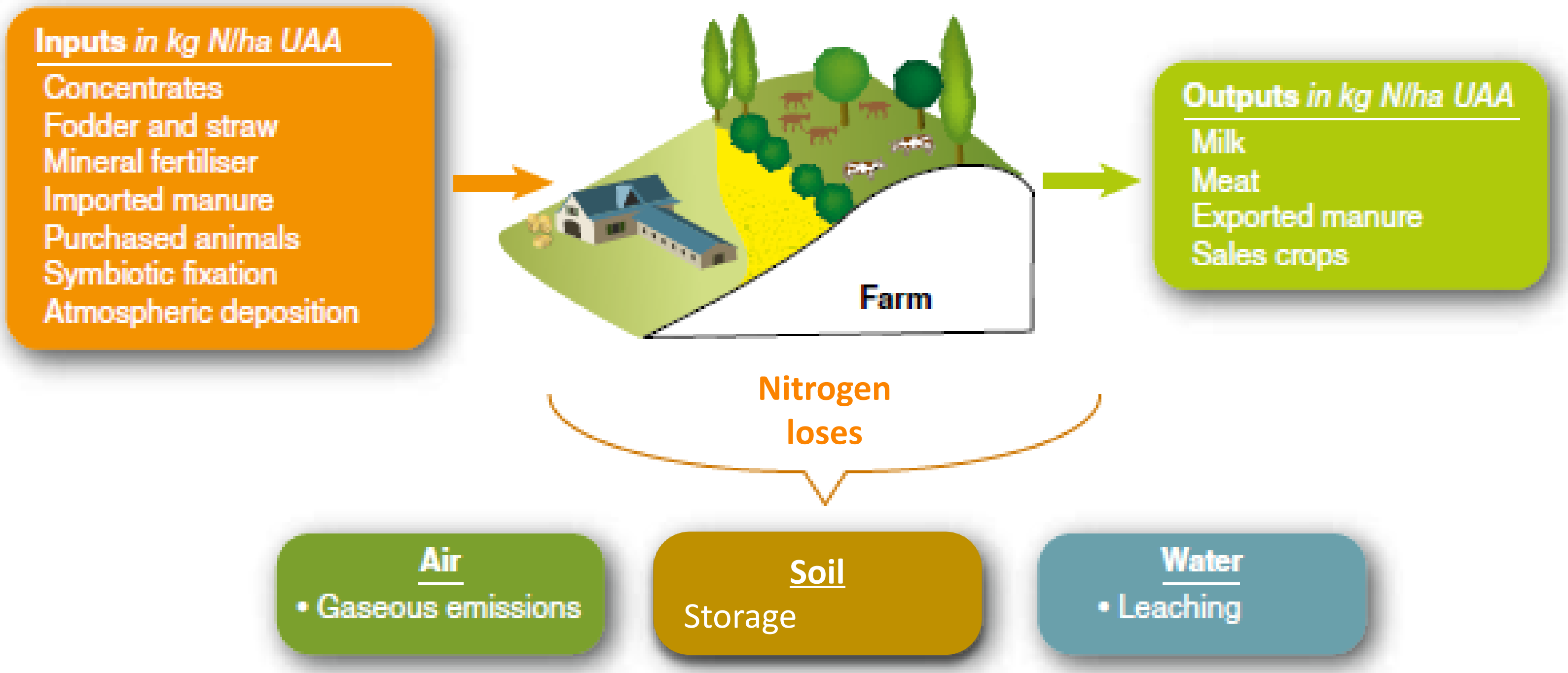
Comparison between the entire population and farms that reduced their emissions

123 variables are compared

The most significant differences are in the variables linked to nitrogen balance :

Variables	V.Test	Mean in category (% evolution)	Overall mean (% evolution)
Nitrogen Balance Input (kg N /ha)	-10,12	-9,80	-2,40
Nitrogen Balance Efficiency (%)	9,35	20,87	10,07

Nitrogen balance at the whole farm level



Discussion / Conclusion

- Sample limits :
  - Mainly from Britany with a few variability of system and advisory organization
  - Mainly between 2013 and 2016 (year effect ?)
  - Only 3 years between two assessments
- A new study, in 2025 ?
  - New data available *(more variability, 5 years between two assessments, improvement payment …)*
- Nitrogen balance synthetic tool to evaluate the farm efficiency
  - Link with the GHG emission
  - Other environmental impacts (NO3 and NH3 loses)
  - Economic management
- Importance of animal efficiency on environmental results

Thank you for you attention

Any questions ?