Testing feeding levers to decrease the carbon footprint of dairy farms.

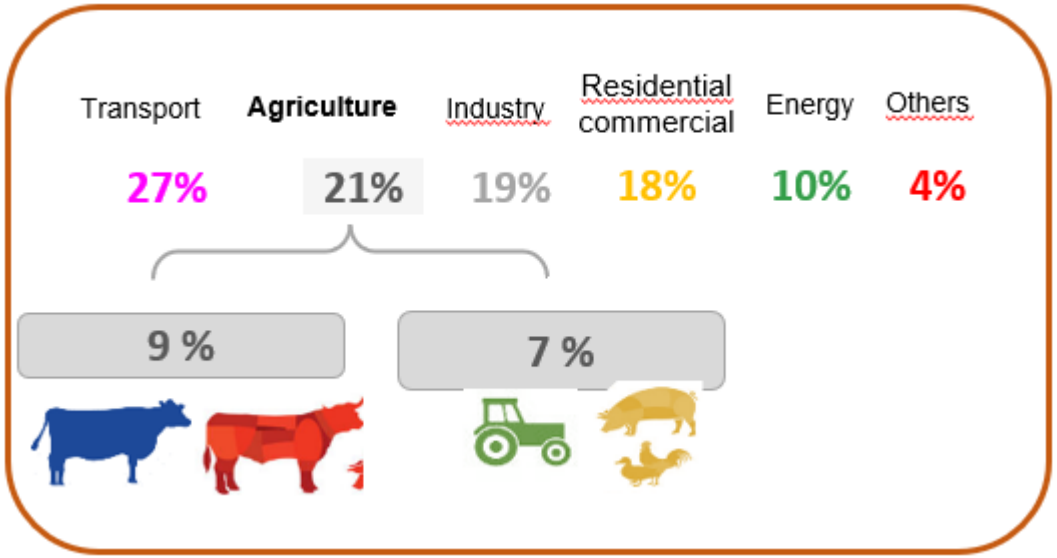
Brocard Valérie[1], Lambert Pauline[1], Tranvoiz Elodie[2]

(1) Institut de l'Elevage, France

(2) Chambre d'Agriculture de Région Bretagne, France

Livestock farming at the heart of major environmental issues

- In France, Cattle farms contribute to **9%** of GHG emissions
- National target: -20% reduction in the carbon footprint of milk by 2025
- In research farms: implementation of **low C footprint systems**
- Further: Test of extra **levers** to decrease the C footprint



Source: CITEPA, 2021

In experimental farms: test, measure, apply, innovate!

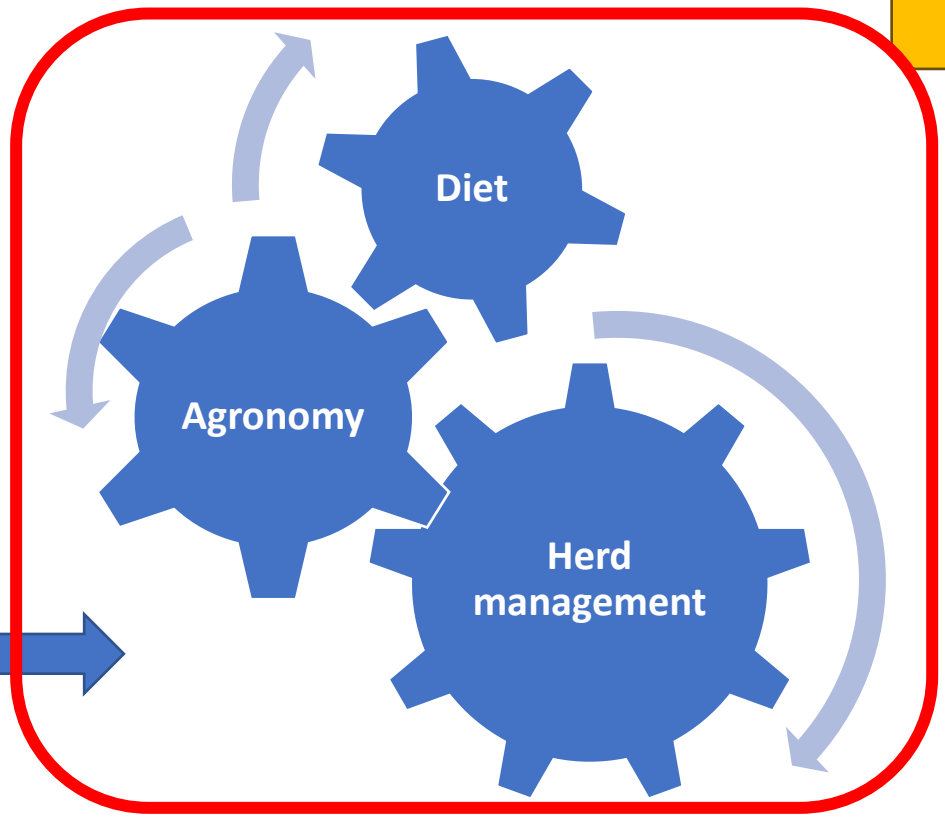
Brocard et al., EAAP 2022

Tests on rations or feed supplements on enteric CH4 emissions

Soil observatory and effects of rotations on fertility, organic matter

Rearing young stock on grass and monitoring growth performance

Analytic test of levers



Global technical/economic/environmental analysis of farming systems

Reduction of production costs with no negative impact on other environmental factors and no production loss

Implementing a global Low Carbon Footprint in an experimental farm

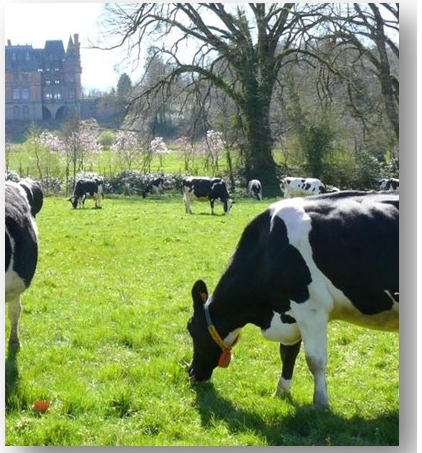
TREVAREZ BAS CARBONE

CAP'2ER®

125 dairy cows

40-45 replacement heifers/year

130ha
- 80ha grass
- 42ha maize
- 8ha cereals

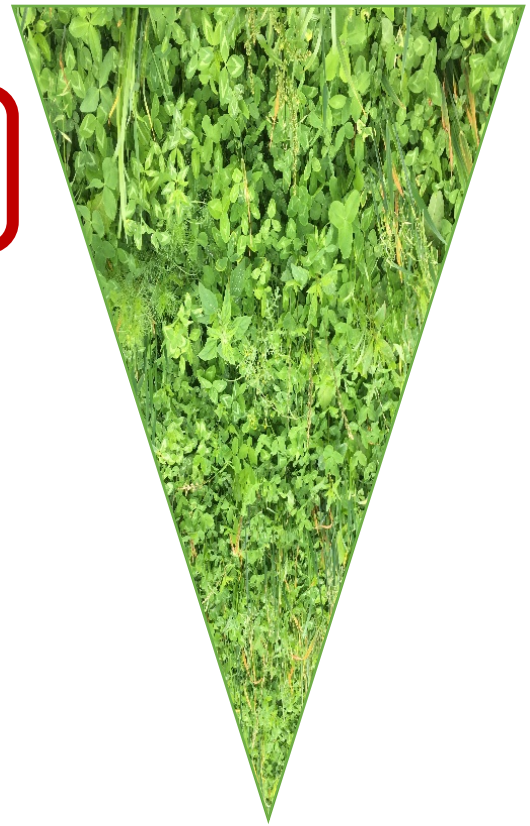


- Aim = 8,000 kg produced per cow per yr
- 0.25 ha grazed grass per cow (regional average)

F@RM XP
LE RÉSEAU DES FERMES PROFESSIONNELLES EXPÉRIMENTALES BOVINS LAIT ET VIANDE
Ferme expérimentale
Trévarez

Potential levers to decrease C footprint and their relative impacts

- Herd management: 10-15%
  - Replacement, heifers, herd health
- Feeding: 2-4%
  - Forage quality, concentrates, protein self sufficiency, grazing
- Crops management: 3-4%
  - Yield, fertilisation
- Energy consumption: 1-2%
  - Fuel, electricity
- Carbon storage: 2-8%
  - Type of grasslands, livespan of the temporary grasslands, renewing/reseeding grasslands, new hedges, agroforestry



ESTIMATED IMPACTS OF SOME TECHNICAL LEVERS ON THE CARBON FOOTPRINT

Production concentrate
- Without

-4%

-6%

Protein concentrate
- Rapeseed

Stage of harvest for grass silage
- Early harvest

-1%

TREVAREZ BAS CARBONE

CAP'2ER®

Age at 1st calving
- 24 months

-2%

Calving period
- 65% Autumn – 35% Spring

0%

Economy, environment, workload?

Going further with feeding levers? 4 experiments

Feeding additive
Grazing legume-rich leys in summer
Ear-corn silage
Fodder beets

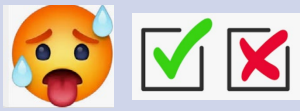
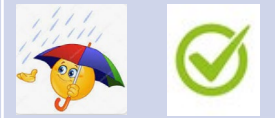
95 g PDI/UFL (16%CP)

Winter Control Diet

N conc
4-5 kg DM grass silage
Ad lib maize silage

Grazing legume-rich leys in summer

- 3 contrasted summers:
- Analytic experiment: 3 months

2021	2022	2023
		

2*20 cows

CONTROL → 100% indoor

EXPERIMENTAL → Indoor + **4h grazing**

cow^{-1} d^{-1}	**Control**	**Experimental**
Maize silage (kg DM)	16	11
Grass silage (kg DM)	4	4
Grazing (kg DM)	0	**Target: 5**
Rapeseed cakes 35%CP (kg)	**4.2**	**2.9**

Replacing concentrate by legume grazing

Grazing legume-rich leys in summer

to reduce N concentrate

2021-23

40 to 66% legumes
17 to 22% CP

Average density
189 to 300 kg DM/cm/ha

Average growth
50 kg DM/ha/d

Carbon Footprint:
0 to -0.03 g CO_2/l milk eq

-2 to 0 kg milk difference

Margin over feeding cost
+0,42 €/cow/d (max)

No effect on milk solids

A self sufficient diet based on grass silage and ear corn silage:

- ear corn silage tested during 2 winters

Diets	Control	ABCD
Maize silage	Ad lib	/
Grass silage (13% CP)	4 kg DM	Ad lib
Ear corn silage	/	5 kg DM
Rapeseed cakes	260 g / kg DM maize	1 kg (Greenfeed)

- With a diet based on ad libitum grass silage and 5 kg DM ear corn silage :

More self sufficiency


-4.2 kg DM intake /cow/d


-7.0 kg milk/cow/d

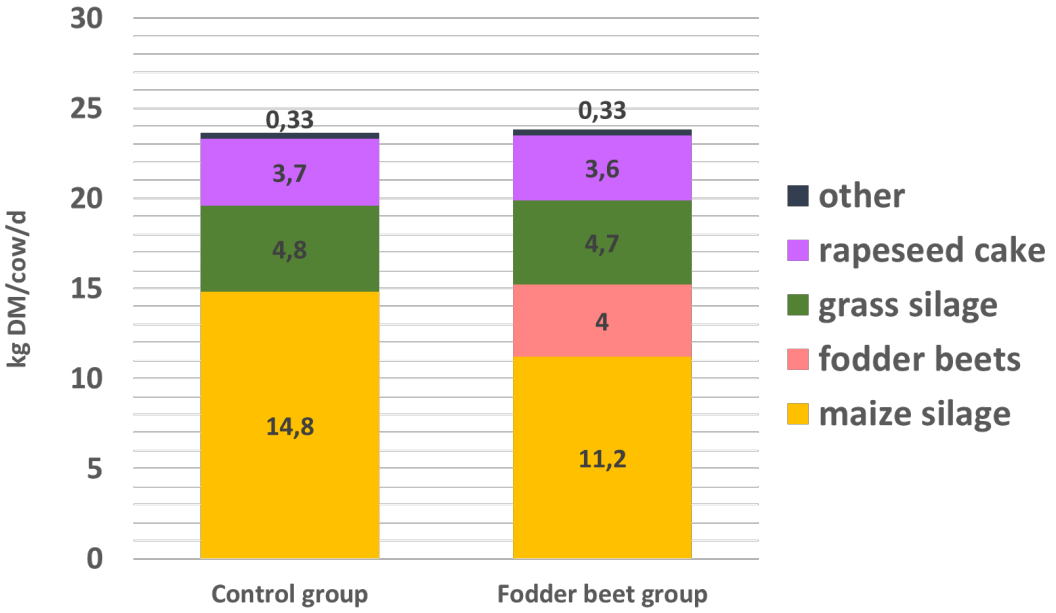

- 1.5 g/kg Protein content

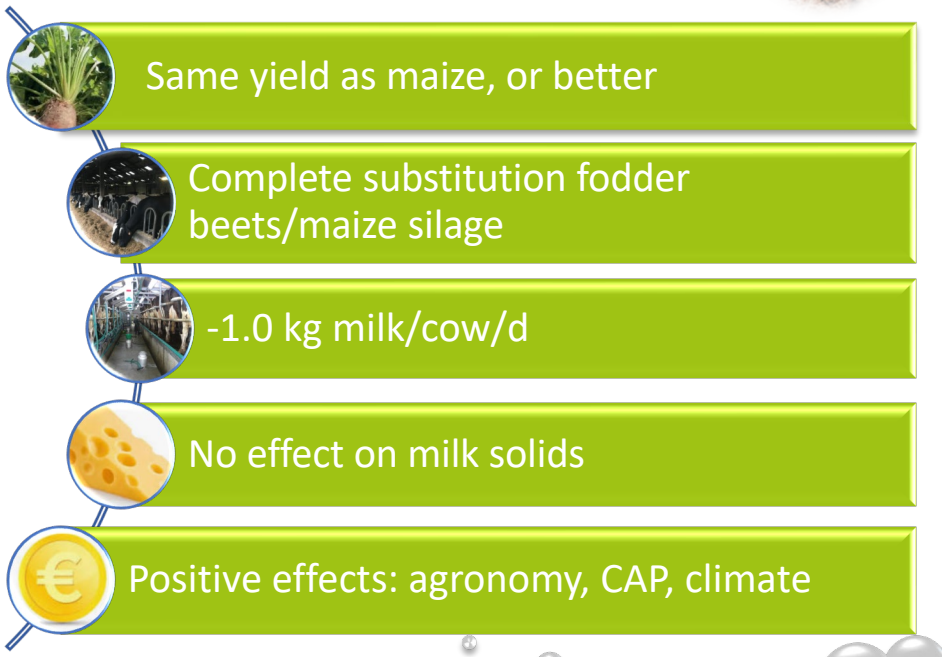

-1.8 € margin over feeding cost/cow/d

No decrease in C footprint

Fodder beets added to maize silage diets: no miracle

- Addition of 4 kg DM fodder beets on a maize silage diet: tested during 2 winters





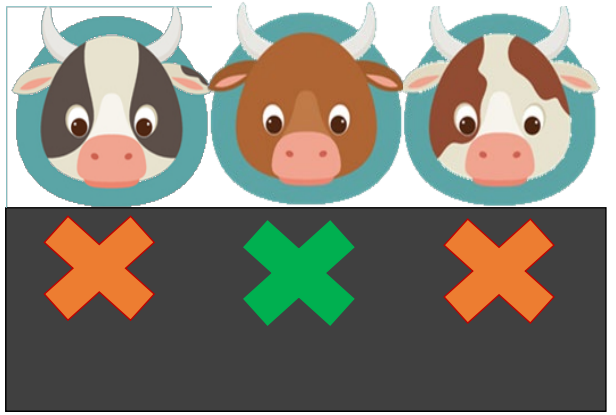
No decrease in C footprint

Feeding additives to reduce the enteric methan?

2 x 20 cows

12 weeks

22 g per day



g/d	-0.8 g/kg milk	g/kg DMI

A slight decrease in CH4 emissions per kg corrected milk

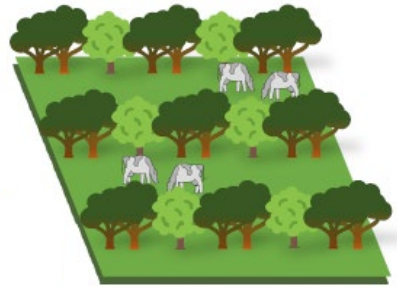
-2% at year level

Benchmarking feeding levers tested:

Feeding additive	 But cost and acceptability?
Grazing legume-rich leys in summer	
Ear-corn silage	 If compensation of milk decrease by + cows
Fodder beets	

Conclusions

- Possible to decrease C footprint on most of dairy farms with simple levers
  - In parallel, reduce dependency on N inputs
  - In Trevarez: 0.86 NCF in 2018, 0.71 in 2022 (g CO_2 per l milk eq.)
- Extra levers: Impact remains limited
  - combine families of levers with consistency
- Usually positive neutral or positive effect on farm profit
  - Workload ?
  - Cost of additives? Acceptability by farmers and consumers?



Conclusions

- A ruminant is ruminating, in particular in low input systems based on forage production (= profitability)
  - Biologic emissions represent 85% of our emissions (CH_4 rumination, N_20 manure management)
  - Compensate C input emissions only? We currently store 100% of the C inputs (fertilisers, rapeseed) under grasslands + root of hedges
  - Change calculation methods (GWP*)?

Grazie mille !!!

valerie.brocard@idele.fr

pauline.lambert@idele.fr

elodie.tranvoiz@bretagne.chambagri.fr

Questions?

LE RÉSEAU DES FERMES PROFESSIONNELLES EXPÉRIMENTALES BOVINS LAIT ET VIANDE