LIFE BEEF CARBON

Effectiveness of the mitigation strategies

CREA Centre for Animal Production and Aquaculture

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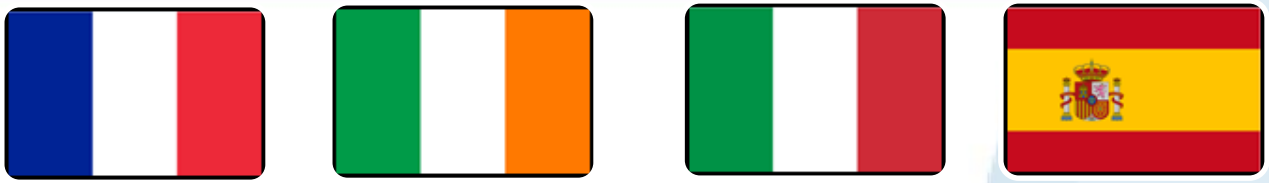
70th Annual Meeting EAAP 2019 Ghent, Belgium

28 August 2019

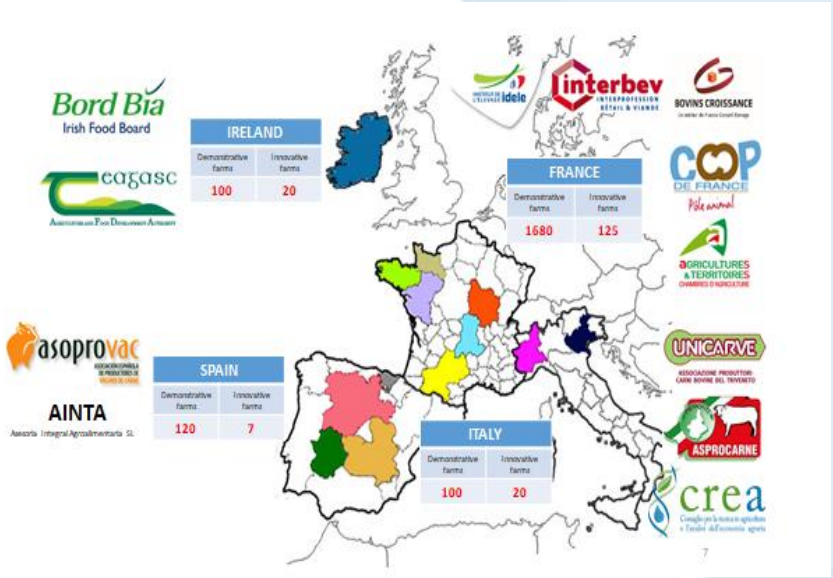
LIFE BEEF CARBON project

4 countries



Project leader: Institute de l'Elevage

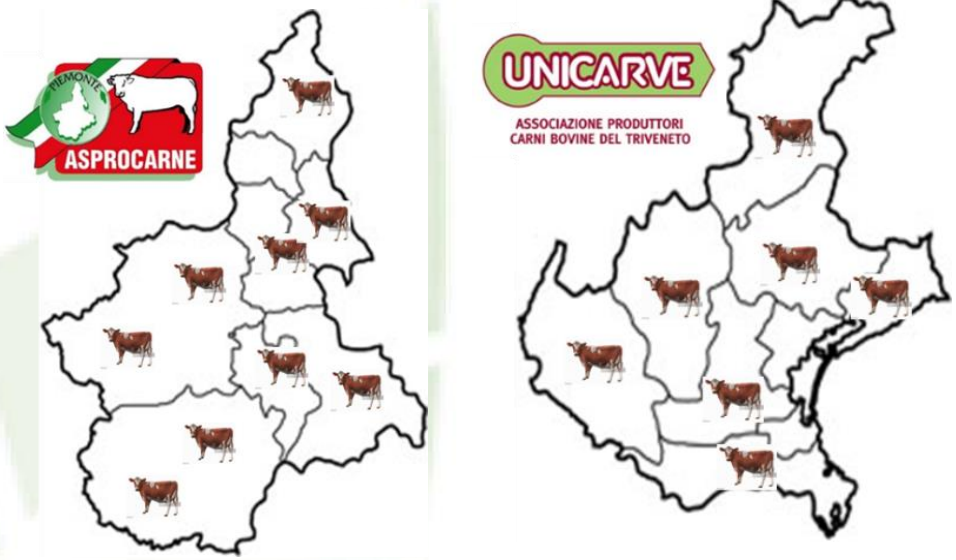
UE team:



2000 beef farms

To reduce the beef carbon footprint by 15% in 10 years;
To promote innovative livestock farming systems ensuring the technical, economic, environmental and social sustainability of beef farms;
To contribute to the implementation of European climate change legislation.

Materials and Methods

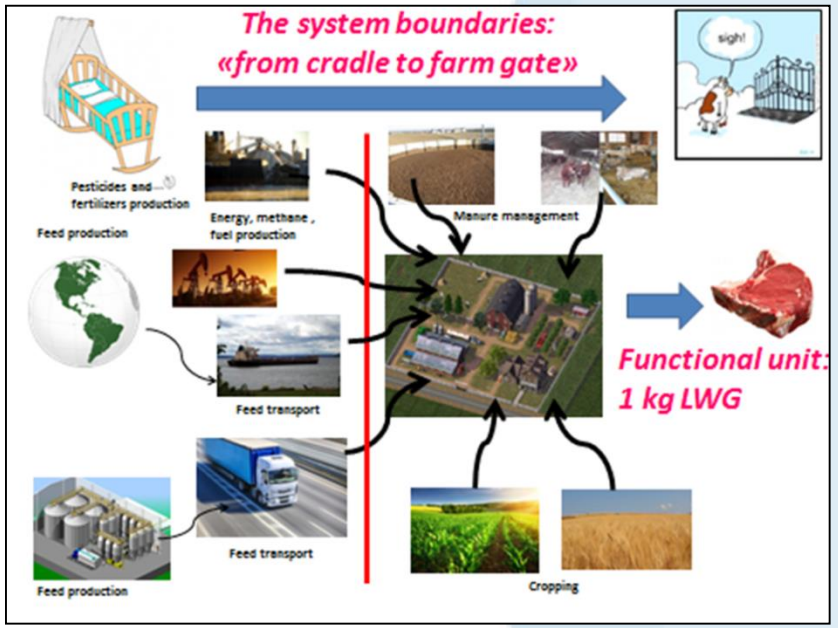


- **20 beef fattening farms** in Piemonte and Veneto;
- **beef farms' mean size**: 66±66 ha;
- **beef genetic types**: Blond d' Aquitaine, Charolaise, Limousine, French cross-bred;
- **mineral fertilisers**: 109±52 kg N/ha;

- **housing systems**: confined closed or open barns with multiple pens, on fully slatted floor or deep litter;
- **diet**: TMR composed of maize, hay, straw, soybean and concentrate on-or-off farm.

Assessments of GHG emissions

CAP'2ER (IDELE, France)



Impact categories

- Global warming (kg CO_2 eq),
- Acidification (kg SO_2 eq),
- Eutrophication (kg PO_4 eq),
- Energy consumption (MJ),
- Biodiversity (ha eq),
- Carbon sequestration (T CO_2 eq).

Statistical analysis:

- Wilcoxon Signed Ranks Test;
- Generalized linear model (GLM);
- Nonmetric multidimensional scaling (NMDS).

All statistical analyses were performed using R, software version 3.4.

Beef carbon action plan in Italy

Animal performance and nutrition	Increase ADG; use of feed additives (coniugated linoleic acid, CLA); smart reduction of CP content of diets; increase fraction of concentrate in diets; substitution of high-energy concentrate diet with high-forage diet; phase feeding.
Animal welfare	  
Manure management and application	Partial or total replacement of deep litter with fully slatted floor; fast incorporation (e.g. injection).
N fertilizers reduction, energy and carbon sequestration	Smart use of chemical fertilizers; optimize soil N level; photovoltaic panels and anaerobic digestion; minimum or no till.

Growth performance and FCR of the beef farms

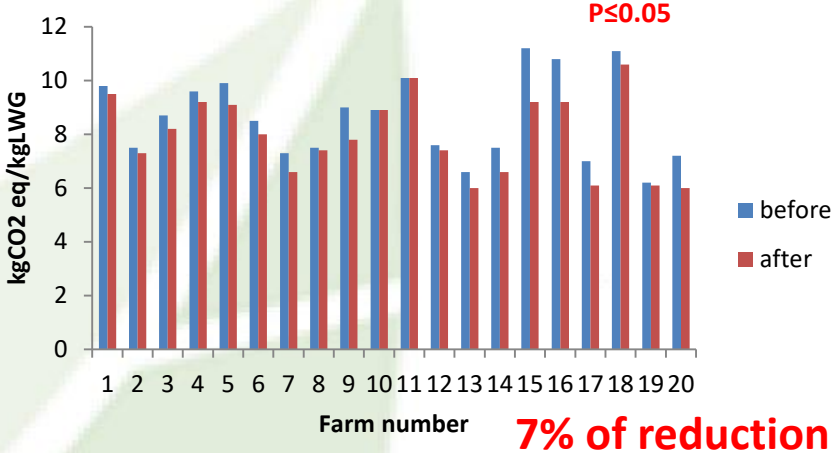
Parameter	Unit	Before (mean ± SD)	After (mean ± SD)	P
Herd size	**number**	**468±334**	**521±352**	*
Initial body weight	kg	332±68	335±70	NS
Final body weight	kg	611±66	616±75	NS
Average daily gain	**kg**	**1.22±0.21**	**1.26±0.22**	*
Initial age	month	10±2.38	10±2.36	NS
Final age	month	18±1.05	18±1.20	NS
Length of fattening period	days	236±75	229±68	NS
Total live weight produced	**T/year**	**213±159**	**259±181**	*
Feed conversion ratio (FCR)	kg feed consumed (DM)/kgLWG	7.18±2.6	6.80±1.9	NS

*= P≤0.05 NS= not significant

Results of GHG emissions

Global warming

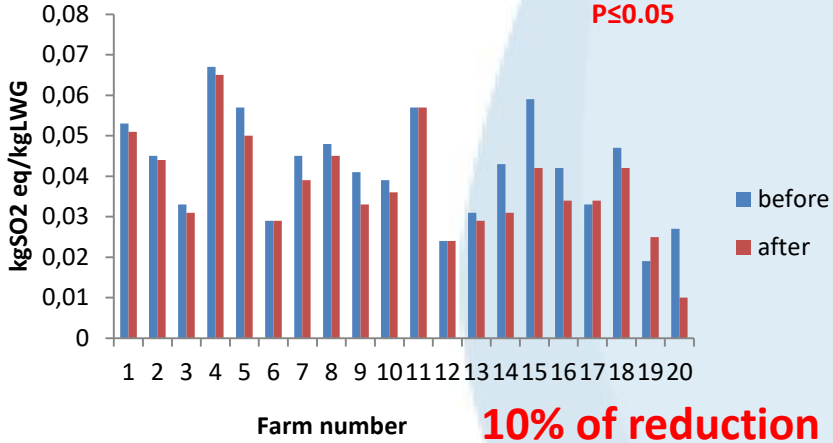
before: 8.60±1.54
after: 7.97±1.45
P≤0.05



7% of reduction

Acidification

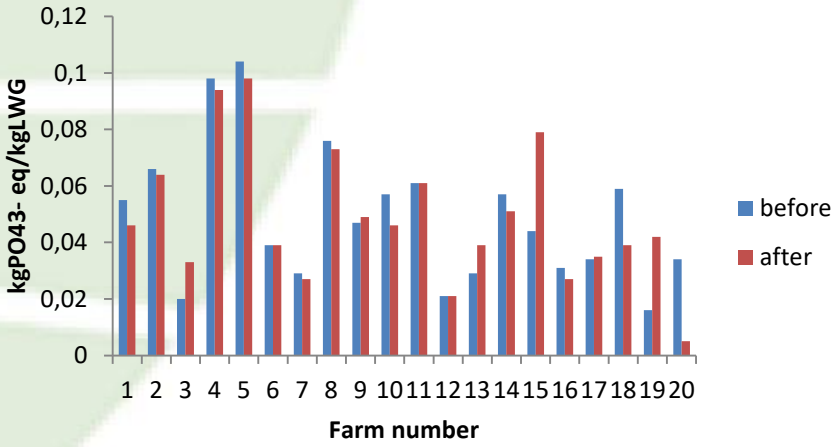
before:0.04±0.01
after: 0.03±0.01
P≤0.05



10% of reduction

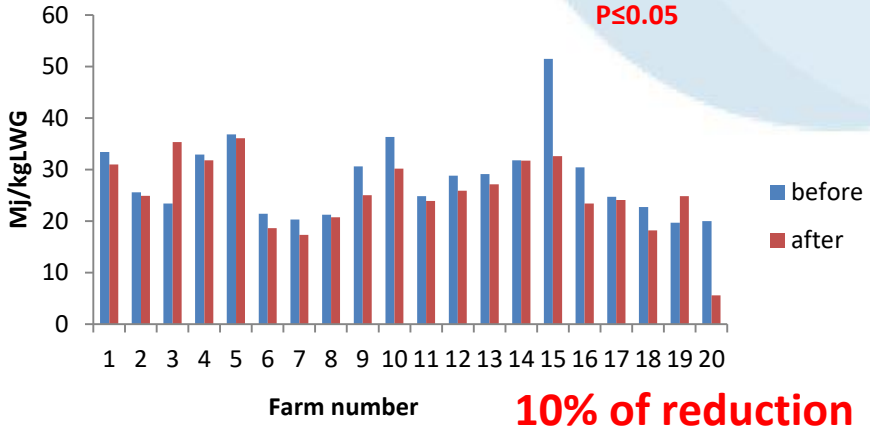
Eutrophication

before: 0.05±0.02
after: 0.04±0.02



Energy consumption

before: 28.3±7.74
after: 25.8±7.75
P≤0.05



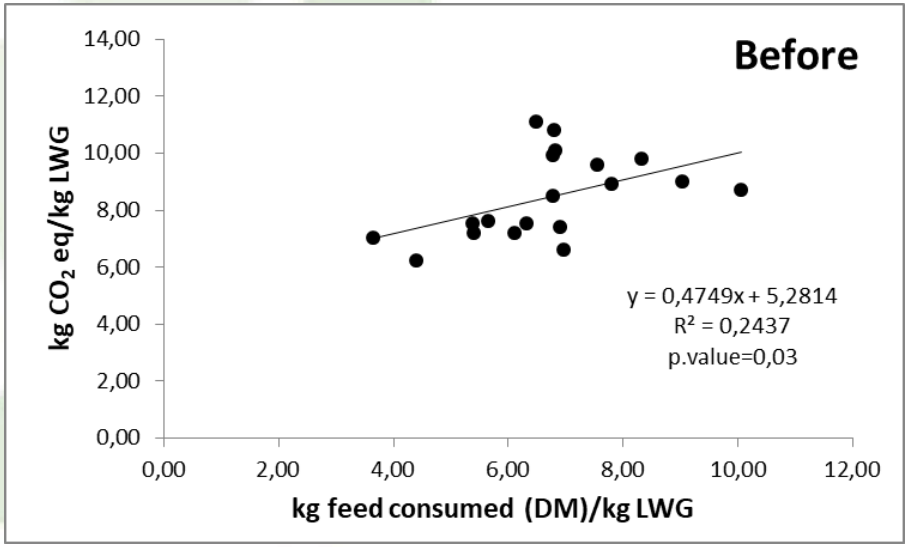
10% of reduction

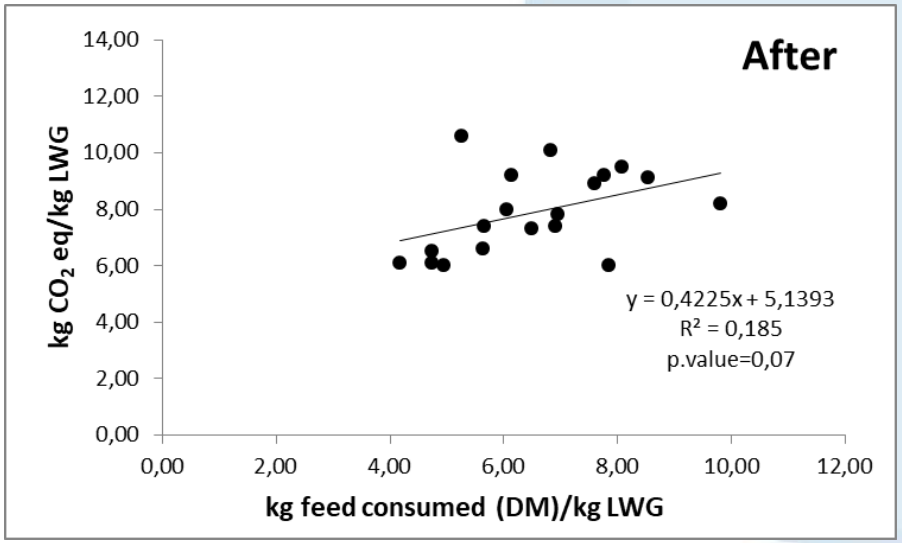
The environmental impact due to the calf and the mother is not included.

Interaction between farm characteristics and environmental impact

Generalized linear model (GLM)

❖ **Relationship between GW and FCR**





❖ **Relationship between GW and FCR and ADG**

Before: GW= (FCR*0.485)+(ADG*0.932)+4.077 R^2= 0.26 p value= 0.08

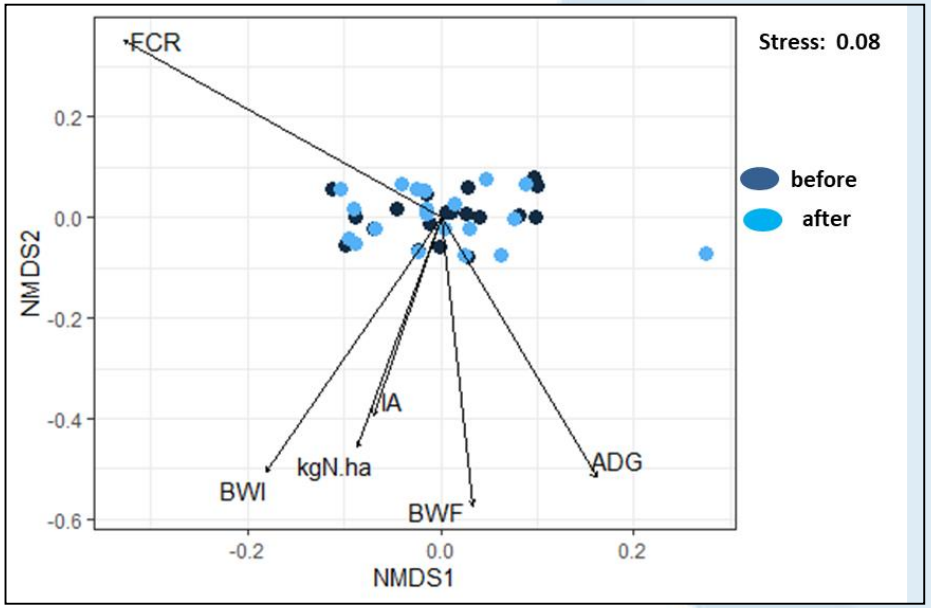
After: GW= (FCR*0.341)+[ADG*(-1.403)]+7.473 R^2= 0.22 p value= 0.14

Interaction between farm characteristics and environmental impact

Nonmetric multidimensional scaling (NMDS)

Parameter	NMDS1	NMDS2	r^2	Pr(>r)
kgN.ha	-0.18458	-0.98282	0.2164	*
FCR	-0.68217	0.73119	0.2317	*
BWI	-0.33738	-0.94137	0.2891	**
BWF	0.05771	-0.99833	0.3301	**
ADG	0.29827	-0.95448	0.2926	**
IA	-0.17411	-0.98473	0.1588	*

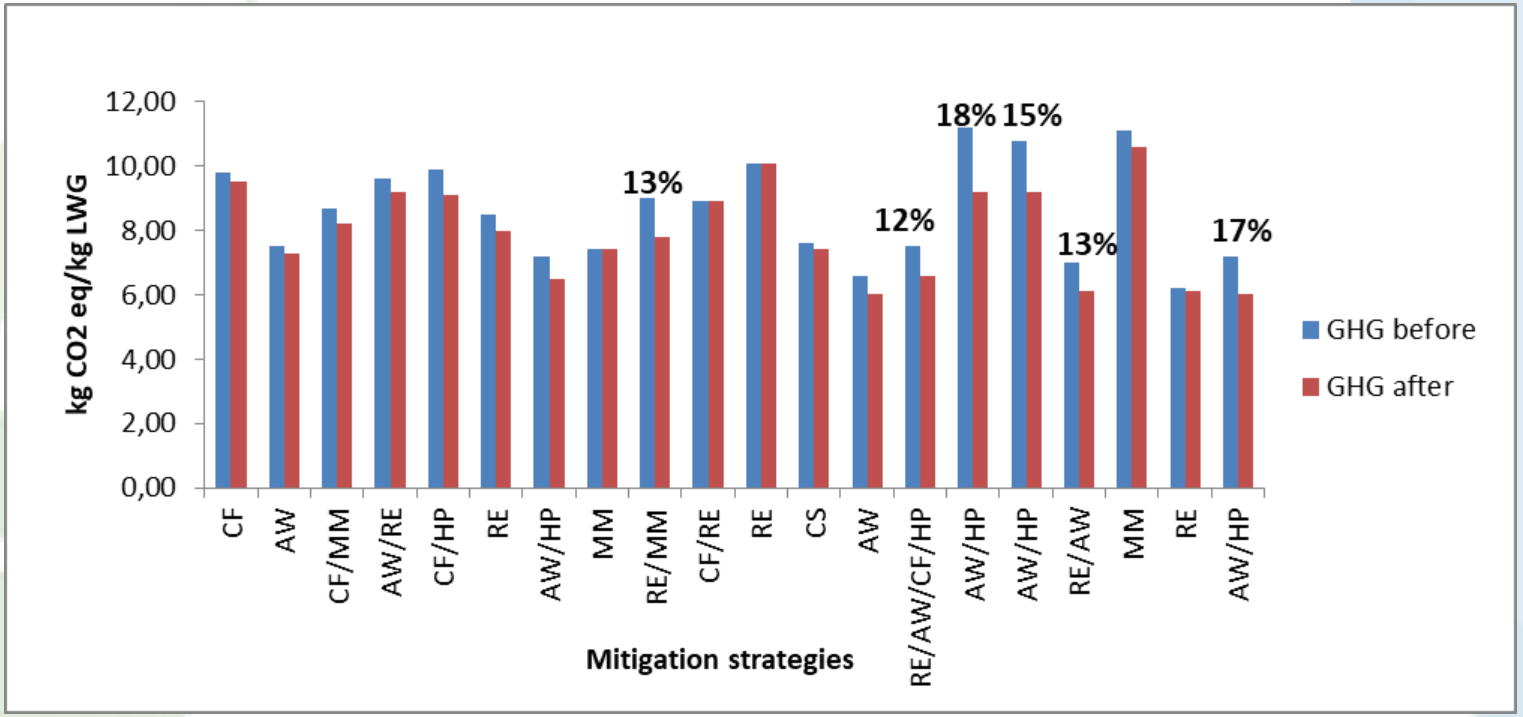
P<0,05=*, P<0,01=; P<0,01=*****



- There is no clear separation of farms before and after the application of the mitigation strategies;

- **Growth performance, mineral fertilizer, feed conversion ratio, initial and final age** have a significant impact on the emissions reduction as conseguences of application of mitigation strategies.

Effectiveness of the mitigation strategies



CF=cattle feeding; **AW**=animal welfare; **CF/MM**=cattle feeding/manure management; **AW/RE**=animal welfare/renewable energy; **CF/HP**=cattle feeding/herd performance; **RE**= renewable energy; **AW/HP**= animal welfare/herd performance; **MM**= manure management; **RE/MM**= renewable energy/manure management; **CF/RE**= cattle feeding/renewable energy; **CS**= carbon sequestration; **RE/AW/CF/HP**= renevable energy/animal welfare/cattle feeding/herd performance; **RE/AW**= renevable energy/animal welfare.

Conclusions

- *It is possible to reduce GHG emissions from specialized fattening beef farms, by adopting the strategies that were chosen by the farmers;*
- *Feed conversion ratio is a good indicator of CF, but it explains only a small part of the variability of this parameter because other strategies (for example substitution of chemical fertilizers, anaerobic digestion) do not influence feed efficiency;*
- *Farms that have reached values of beef CF reduction close to or above 15% have adopted more than one mitigation strategy.*

crea
Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

Beef Carbon

Thanks

to farmers who kindly shared data

Life