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## Producing lambs while limiting concentrates in various pedoclimatic contexts: which performances?

Marc Benoit, Bertrand Dumont, Rodolphe Sabatier, Jacques Lasseur, Philip Creighton

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Marc Benoit, Bertrand Dumont, Rodolphe Sabatier, Jacques Lasseur, Philip Creighton. Producing lambs while limiting concentrates in various pedoclimatic contexts: which performances?. 3rd cycle. France. 2021. hal-03579339

**HAL Id: hal-03579339**

**<https://hal.science/hal-03579339>**

Submitted on 18 Feb 2022

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Theix, 8th and 9th July 2021

**GREENANIMO**

Farming systems training

*“Optimising economic and environmental performances of sheep-meat farms  
does not fully fit with the meat industry demands”*

*Producing lambs while limiting concentrates in various  
pedoclimatic contexts: which performances?*

**M.Benoit, B.Dumont, R.Sabatier, J.Lasseur (INRAE) Ph.Creighton (Teagasc)**



# Background

## Decrease in European sheep production

- **Profitability** / Production cost, in particular **feed** and **equipments**
- Workload

## Global stakes

- Livestock contribution to **Climate change**
- **Energy** consumption
- **Feed-food** competition

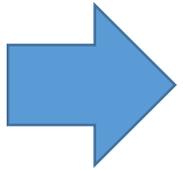
## Great variability

- In farm performances (technical and economic)
- Pedit-climat contexts
- Breeds

# Aims

In a **large diversity of context**

For **optimized sheep farming systems** (output/input)

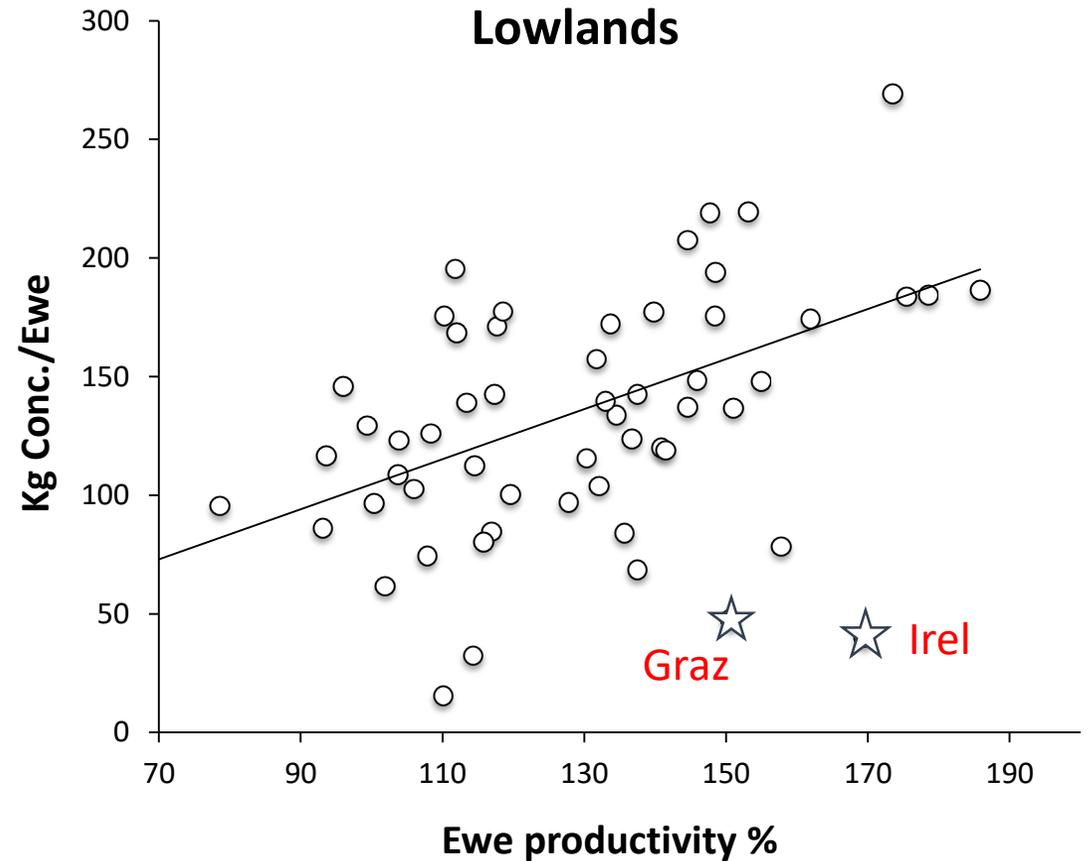
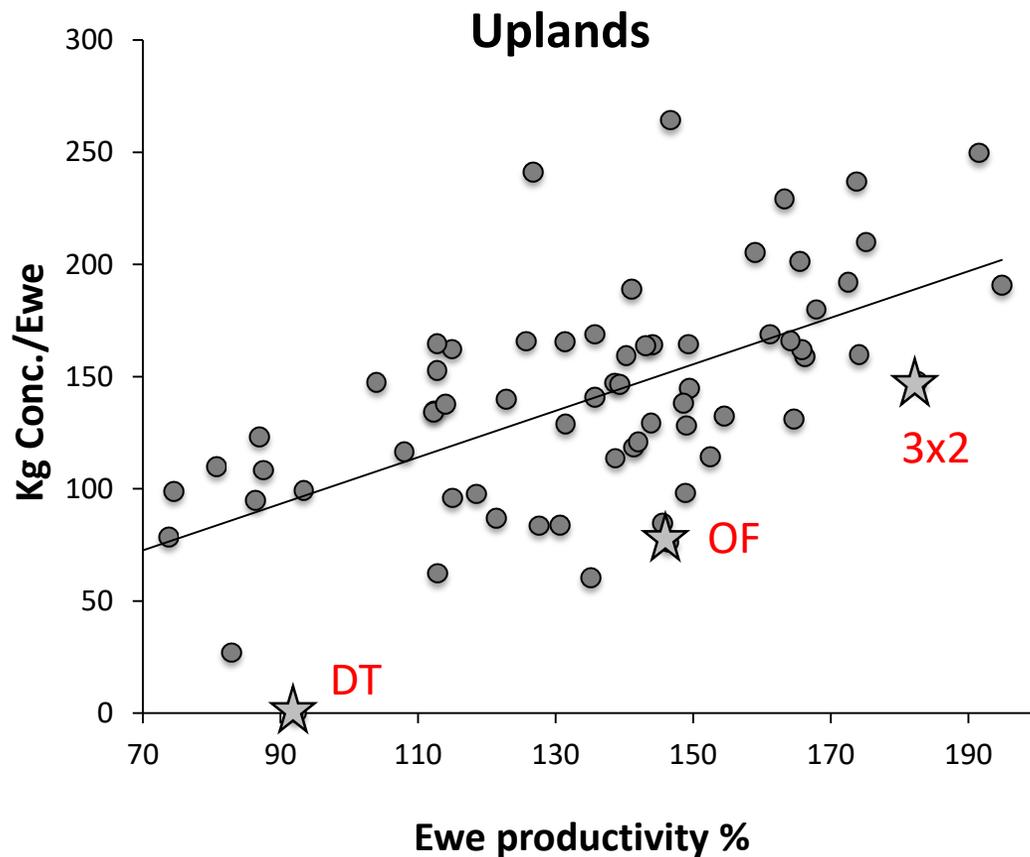


- What strategies?
- What results? Technical, economic, environmental, feed-food
- What consequences?

# Choice of 5 farming systems

Ewe productivity : Major impact  
Concentrate use

1482 years- farms (1987-2016) - 118 farms (12 years in average)



# 5 contrasting farming systems 1/2



**Irel** Belclare

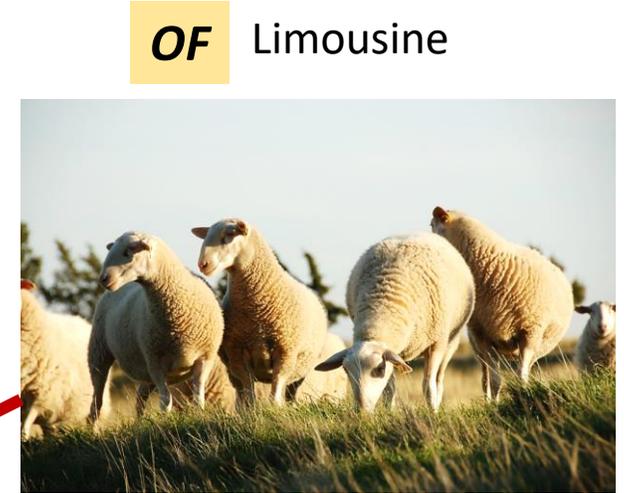


**Graz**  
Mouton Vendéen  
Texel

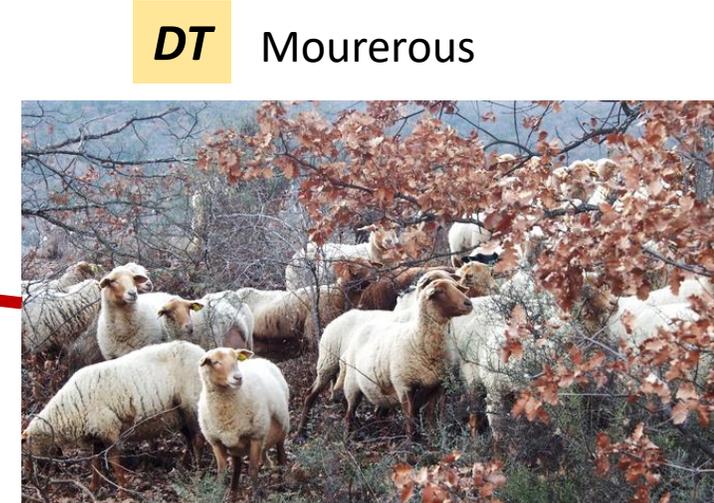


**3x2**  
Rava x Ile de France

ΕΠΙΣΤΗΜΟΝΙΚΟΙ – ΕΠΙΣΤΗΜΟΝΙΚΟΙ – ΕΠΙΣΤΗΜΟΝΙΚΟΙ sheep farming systems



**OF** Limousine



**DT** Mourerous

# Simulation tool and performance indicators

## OSTRAL (simulation tool)

- **Standardisation**
  - Economic situation (2015)
  - Adequation of equipments
- **Extrapolation for Irel. System**  
(60 → 420 ewes)
- **Indicators calculation**

[Technical indicators (flock perf.; feeding; ...)]

- **Feed/food competition**  
(protein) (*Ertl et al 2015, Wilkinson 2011...*)
- **Economics**
  - Net Income /worker
  - Added value /worker
  - Net Income/assets
- **Environment**
  - N balance
  - Gross and Net GHG emissions/kg carc (LCA)
  - MJ/kg carc (LCA)
- **Market adequacy**
  - Lambs selling Regularity
  - Lambs Conformation

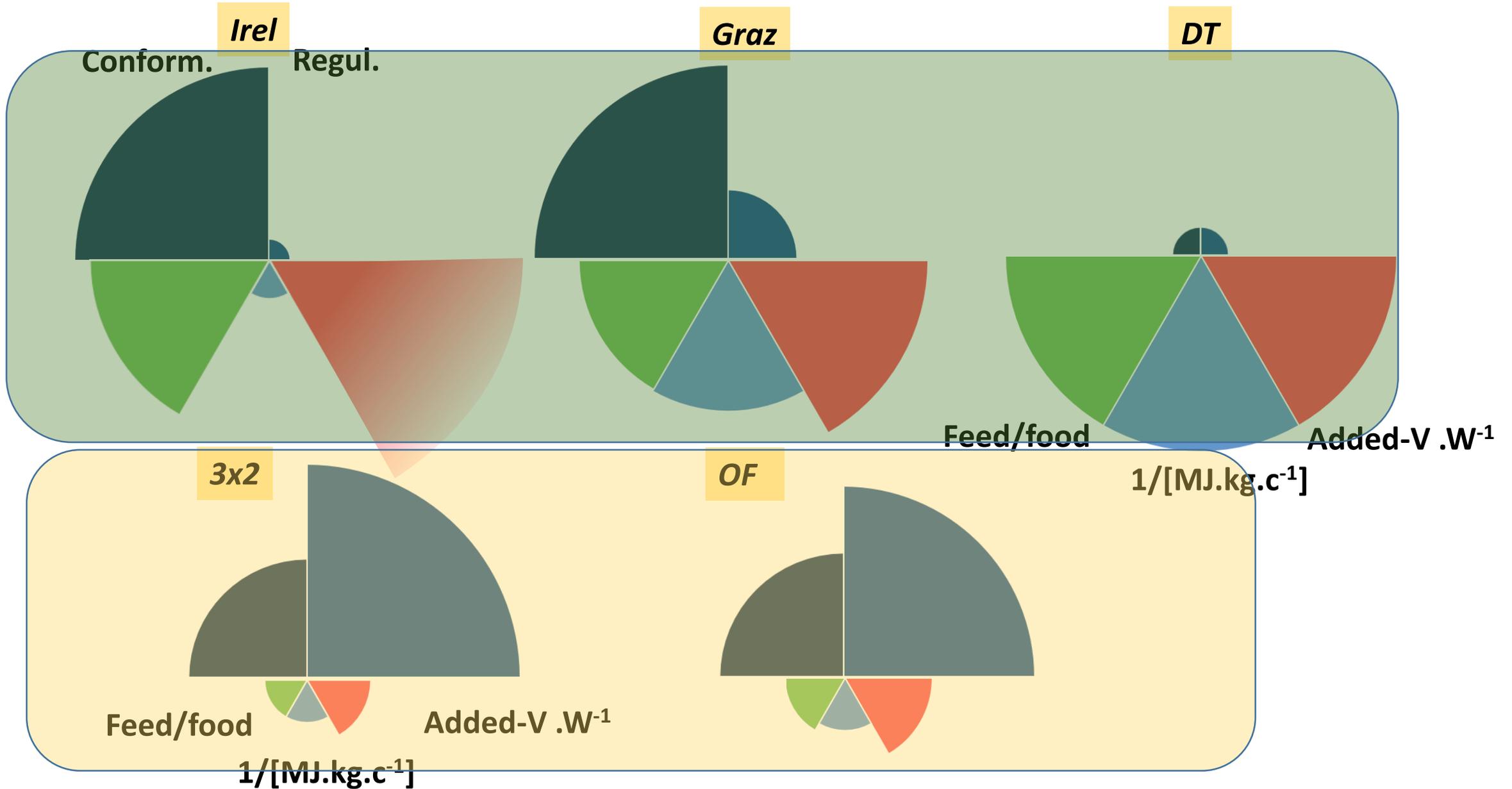
# Main characteristics and performances

	Irel	Graz	3x2	OF	DT
No ewe (>6 mths)	420	541	470	405	2105
Stocking rate (ewe/ha Fodder Area)	11.4	6.6	8.7	4.4	0.5

Ewe productivity (+6mths) (%)	154	133	166	132	82
Ewe mortality (%)	8.3	3.3	5.8	4.8	18.9
Concentrates (kg.kg carc <sup>-1</sup> )	1.22	1.55	5.24	3.41	0.00
Fodder self-sufficiency (%)	95	94	78	88	100

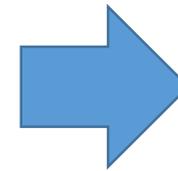
Added value (€·W <sup>-1</sup> )	21400 (44000)	31700	19800	22500	31900
Gross GHG emissions (EqCO <sub>2</sub> .kg carc <sup>-1</sup> )	21.7	18.3	22.5	24.8	28.6
Net GHG emissions (EqCO <sub>2</sub> .kg carc <sup>-1</sup> )	19.2	13.7	16.6	8.5	-130.0
Total MJ Non Renew. Energy (MJ.kg carc <sup>-1</sup> )	50.6	31.4	50.9	47.6	22.7
Effic. conversion of edible proteins (%)	158	125	33	51	∞

# Synthesis of overall performance

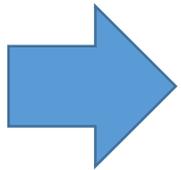


# Discussion

- Fodder self-sufficiency
  - **high seasonality** of reprod. & fattening
- Harsh environment and resources
  - rustic breed → **low lamb conformation**



**Low market compliance**



- Cross organisation between territories ? (regularity)
- Consumers education? ...in relation with labelling, certification and specificities
- Specific markets/consumers (ex: DT lambs for Muslims)

# Conclusion

Very high use of fodder resources  
// Farm sustainability

Sheep industry standards

Agronomy for Sustainable Development (2019) 39:40  
<https://doi.org/10.1007/s13593-019-0588-9>

RESEARCH ARTICLE

Optimising economic and environmental performances  
of sheep-meat farms does not fully fit with the meat  
industry demands

Marc Benoit<sup>1</sup>  • Rodolphe Sabatier<sup>2</sup> • Jacques Lasseur<sup>3</sup> • Philip Creighton<sup>4</sup> • Bertrand Dumont<sup>1</sup>

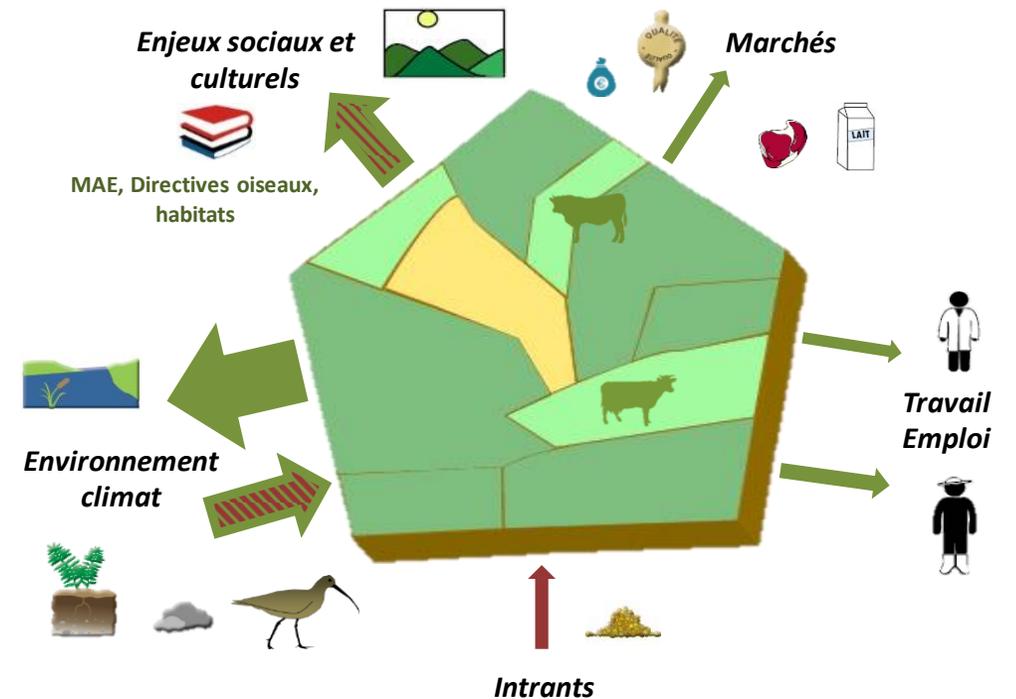


# A second approach to be studied:

## Other services and impacts

Socio-economics, patrimonial aspects, nutritional quality, biodiversity, landscape

→ *Use of Conceptual framework*  
(Dumont et al, Animal 2018)



# A third approach:

What **sensitivity** of these 5 efficient farming systems  
**to technical and économique hazards?**

Agronomy for Sustainable Development (2020) 40:34

<https://doi.org/10.1007/s13593-020-00638-z>

RESEARCH ARTICLE



## Assessment of the buffering and adaptive mechanisms underlying the economic resilience of sheep-meat farms

Marc Benoit<sup>1</sup>  • Frédéric Joly<sup>1</sup> • Fabienne Blanc<sup>2</sup> • Bertrand Dumont<sup>1</sup> • Rodolphe Sabatier<sup>3</sup> • Claire Mosnier<sup>1</sup>

# Types of hazards taken into account

- **Technical**

- Fertility of ewes and ewes-lambs
- Prolificacy
- Lambs mortality

NB : Seperate hazards / lambing season

- Normal Distribution of hazards
- All hazards combined (3 tech. + 3 eco.)
- Independence of the 6 variables supporting the hazards

- **Economics**

- Price of lamb meat
- Price of concentrate
- Energy price → Fuel, N fertilizers, Powdered milk

# Simulation tool and performance indicators

OSTRAL (simulation tool)

- At farm scale (flock batches for reproduction, inputs, outputs ...)
- Indicators calculation

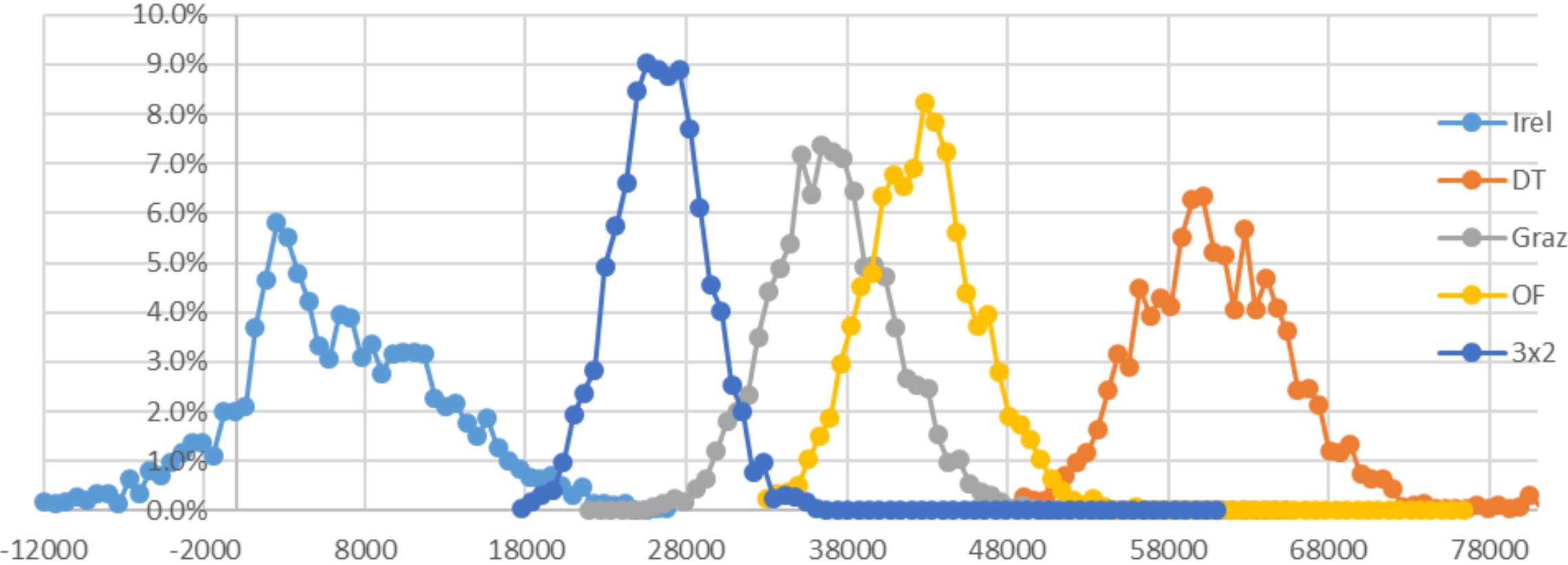
Technical, **economic**, environmental, feed-food criteria.

Possibility to generate series of iterations, changing technical or economic parameters

We run 3000 iterations for each farming system (hazards on these T & E var.)

# Analysis of global Net-Income variability (Hazards on 6 variables)

## Frequencies



Net Income / F.worker (€)

Marc Benoit – Efficient sheep farming systems

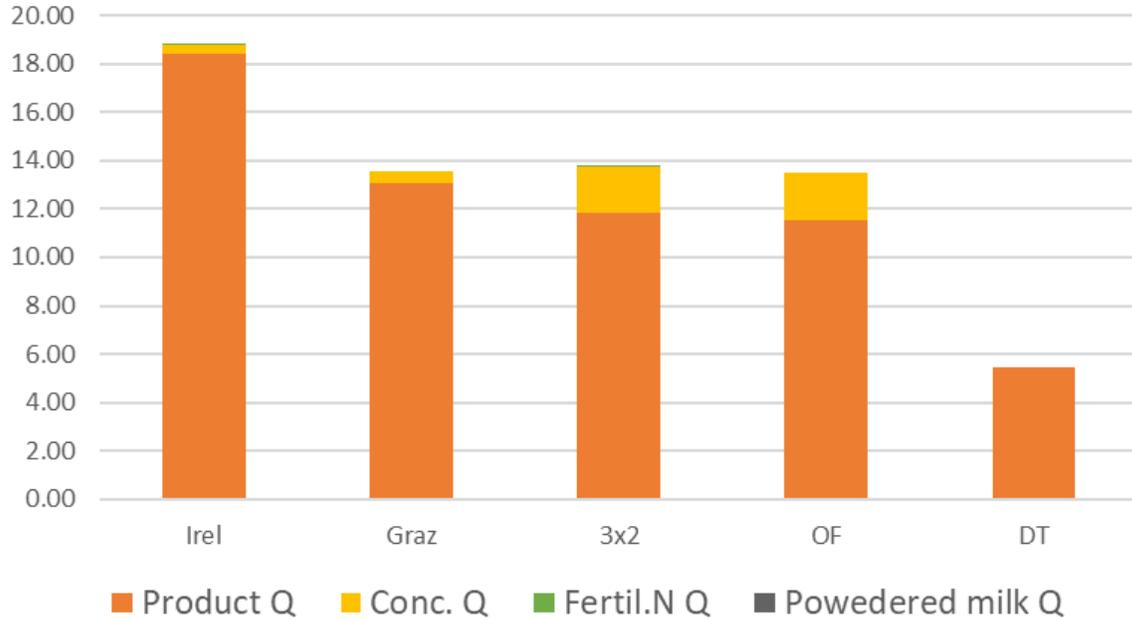
# Zooth. effects

hazards on fertility, prol, mortality

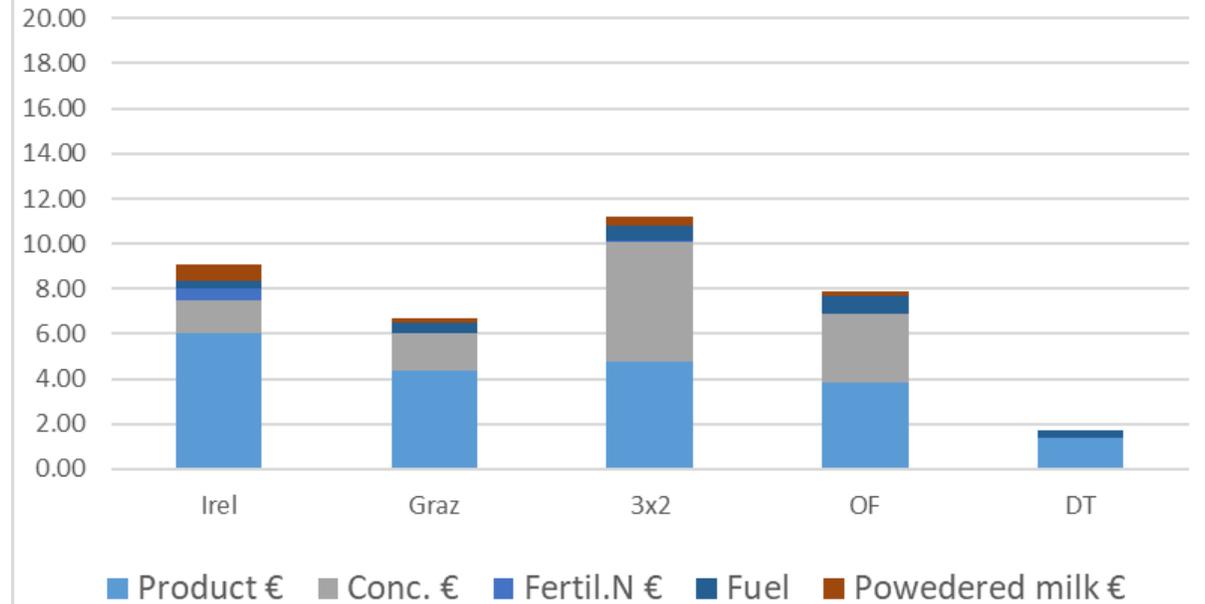
# Prices effects

hazards on prices: meat, feed, energy

SD (€) per ewe



SD (€) per ewe



# Net income SD lower than the Sum of all SDs

Sum SDs > Net Income SD

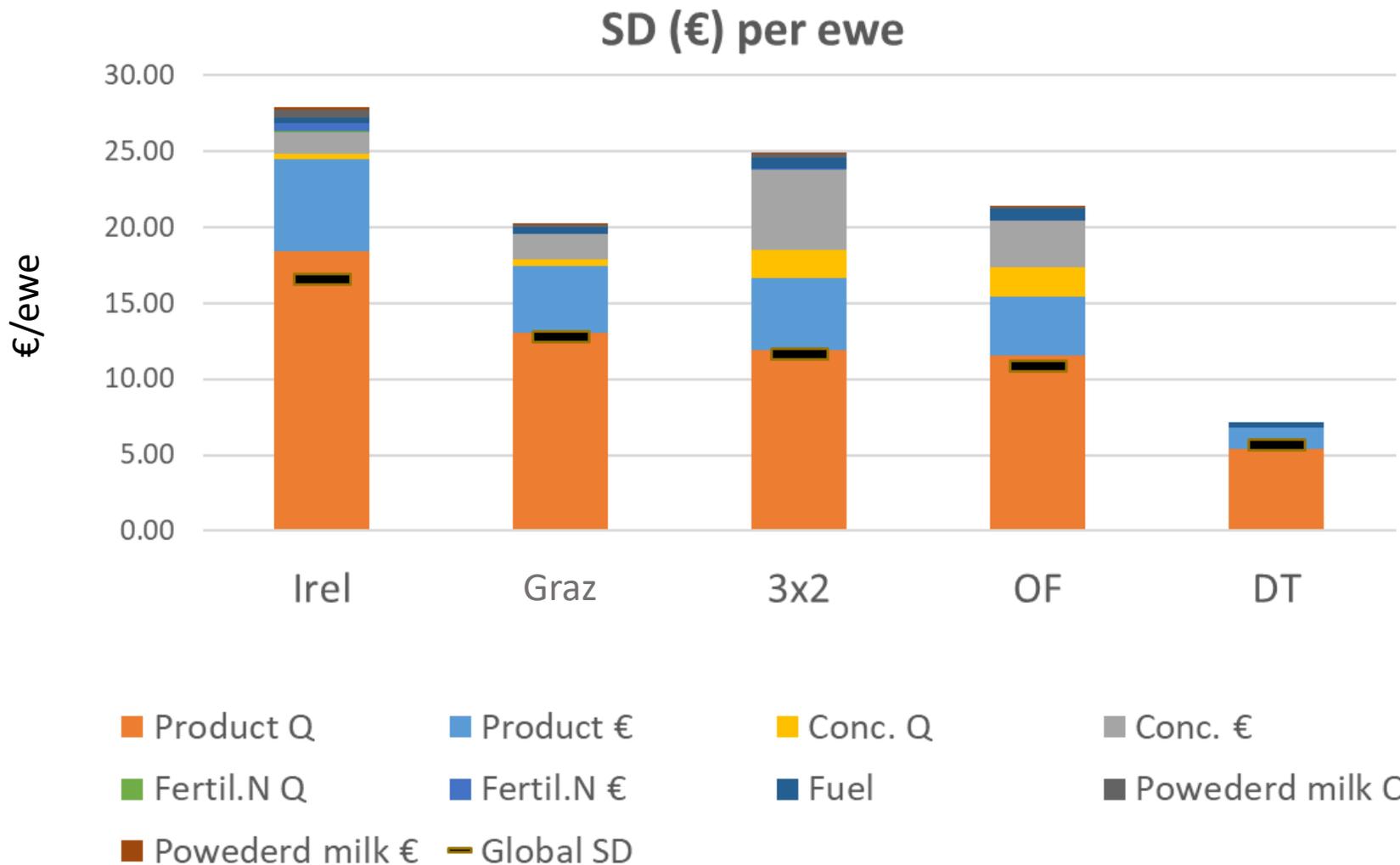
→ Compensations

High compens. for 3x2

(concentrates/lambs)

Very low Income SD for DT,

3.5 times more for Irel



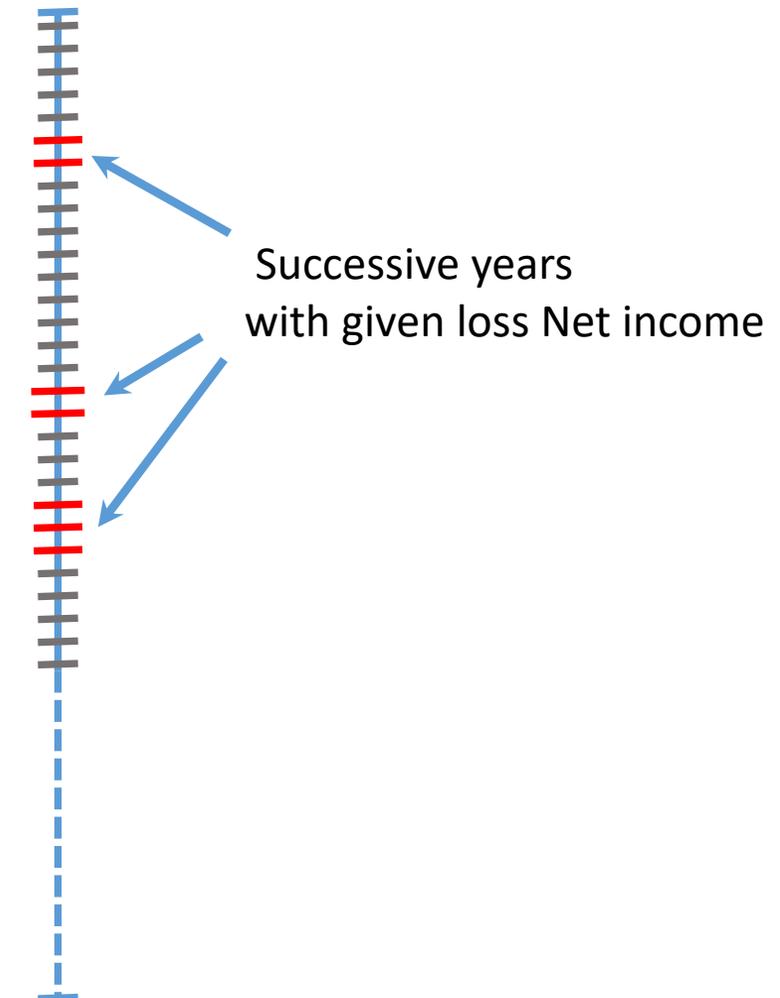
# Farm resilience as succession of low income years

→ We study the successions of 2 years with a standard level of **revenue loss** among a series of 3000 successive iterations with randomness on the 6 previous variables.

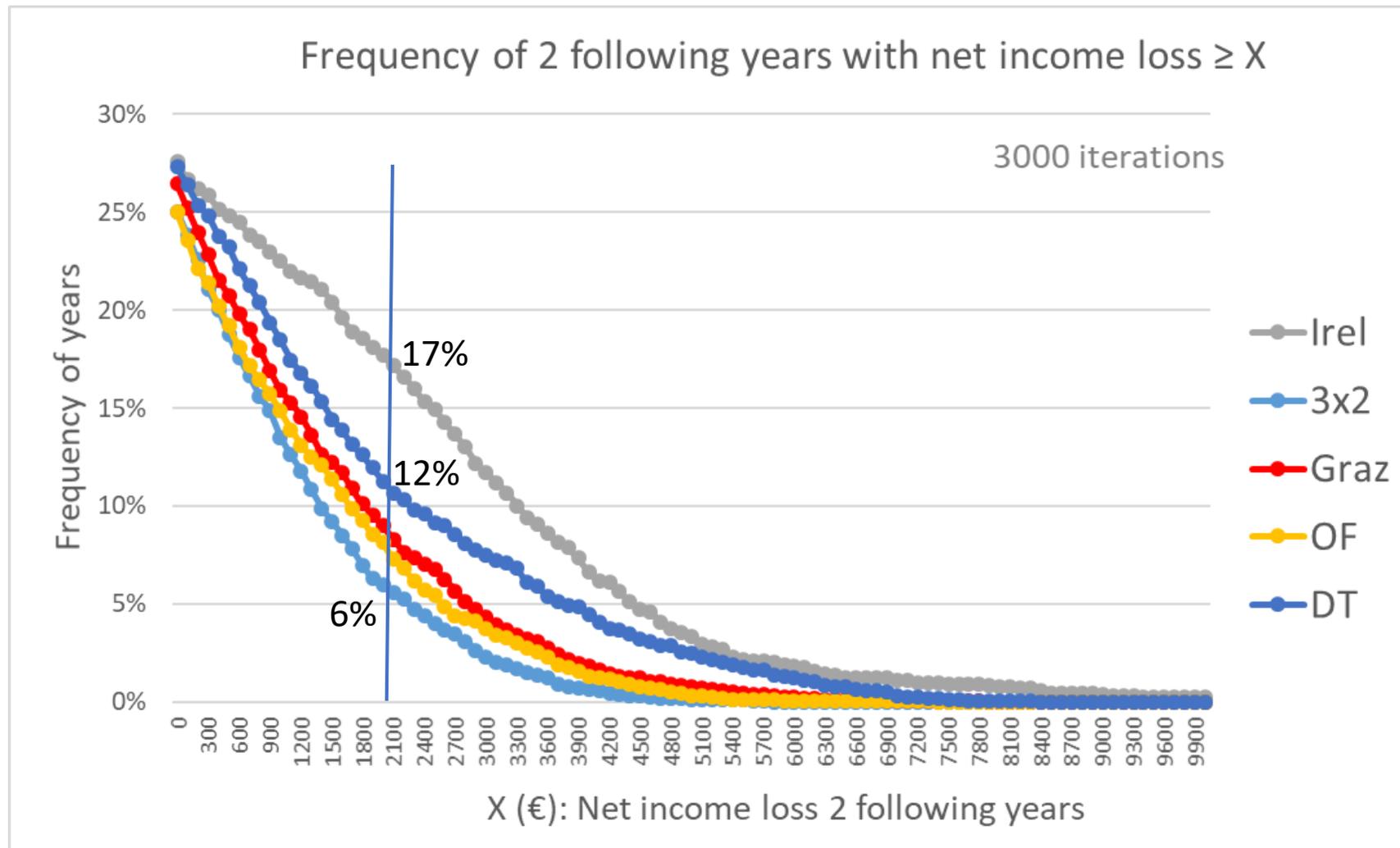
Same series of hazards for the 5 farms (same chronological order)

→ Frequency = [No of successive years with loss net income > x€ ] / 3000

1 farm, 3000 iterations (years)



# What ability of farming systems to face 2 difficult years?



**Irel:** very breakable farming system

**DT:** rather high frequency of high loss of net income

**3x2:** very strong farming system

# Conclusion

- Strong buffer effects in relation with variables supporting hazards are independent and when there are 2 or 3 lambing periods a year
- An adaptive effect when there are 2 or 3 lambing periods a year giving the possibility to move empty ewes from one batch to the other
- 3x2, even if the most intensive farming system, shows the most stable income...
- ...but DT, thanks to a very good net income can be considered as the most resilient, on the basis of the lower net income coefficient of variation.
- Modeling is very interesting to study impacts of hazards on farm performance ...but some types of hazards could be included (climate, work for example)

# Thank you for your attention





# 5 contrasting farming systems 2/2

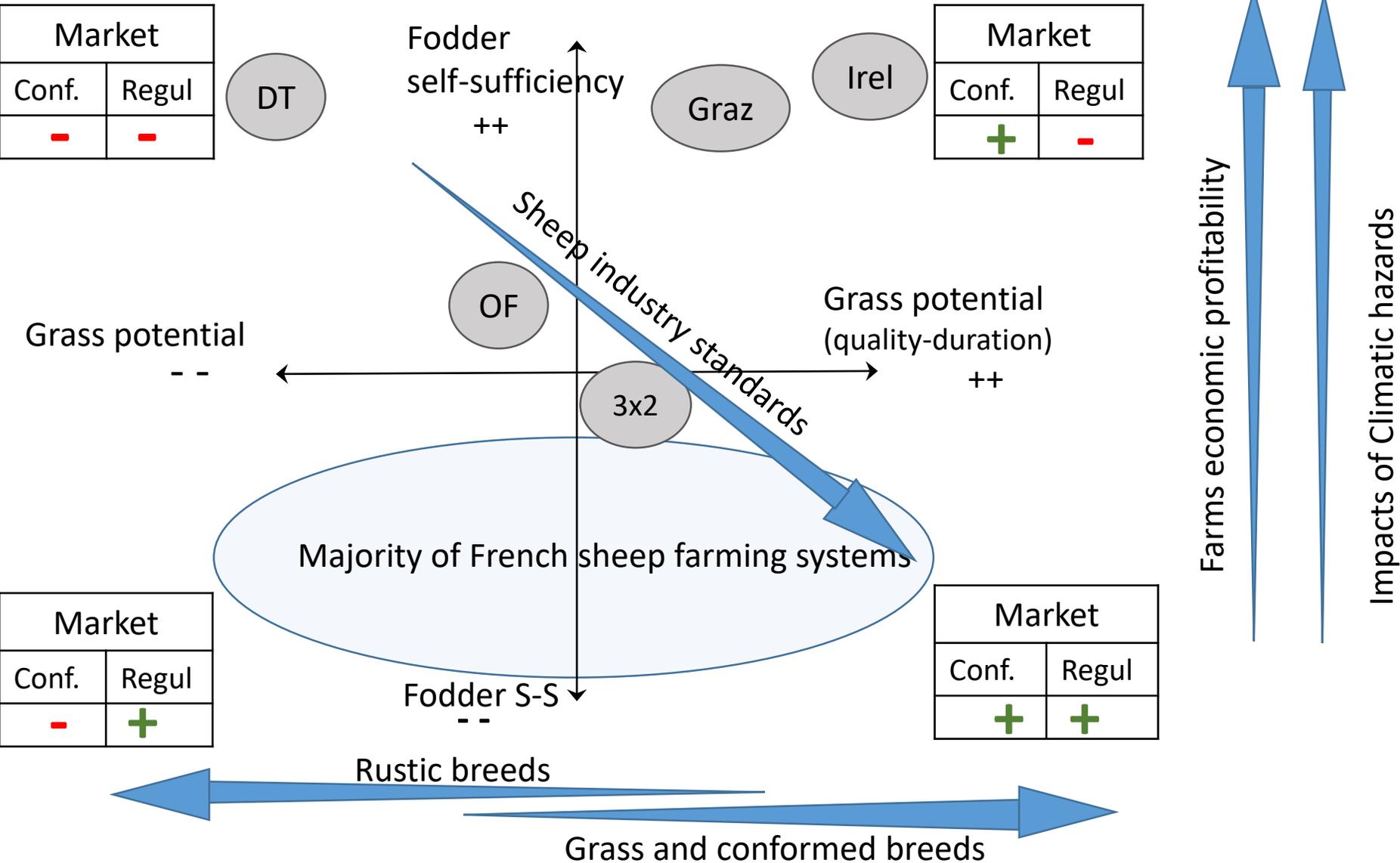
Irel	Graz	3x2	OF	DT
<b>Plain</b>	<b>Plain</b>	<b>Mountain</b>	<b>Mountain</b>	<b>Mountain /pastoral</b>
Oceanic climate	Temperate	Continental	Continental	Mediterranean
Grass-based Intensive pastures (experimental device)	Grass-based system	Intens. Repro. Syst High ewe product	Grass-based Organic farming	Double transhum. 0 → 2500m alt. Harsh conditions
One lambing period (end winter) High meat and N/ha	One lambing period ; grass- fattened lambs No N fertilis.	3 lambing period Lambs indoors	2/3 spring lambings (grass- fattened lambs); 1/3 in autumn	Two lambing periods (March - October) No concentrate

# Main characteristics and performances

2015  
42 farms (Inra)

	Irel	Graz	3x2	OF	DT	Average (High lev.)
Total Agricultural Area (ha)	36.8	81.9	53.9	91.9	4463	110
Stocking rate (ewe/ha Fodder Area)	11.4	6.6	8.7	4.4	0.5	5.3
No ewe (>6 mths)	420	541	470	405	2105	556
Work productivity (eq.Livestock Unit.W <sup>-1</sup> )	66.3	54.6	46.0	59.7	72.5	61.5
Ewe productivity (+6mths) (%)	154	133	166	132	82	126
Ewe mortality (%)	8.3	3.3	5.8	4.8	18.9	6.3
Concentrates (kg.kg carc <sup>-1</sup> )	1.22	1.55	5.24	3.41	0.00	7.5
Fodder self-sufficiency (%)	95	94	78	88	100	71
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Total MJ Non Renew. Energy (MJ.kg carc <sup>-1</sup> )	50.6	31.4	50.9	47.6	22.7	71
Effic. conversion of edible proteins (%)	158	125	33	51	∞	30 ??

# Stakes representation



# Buffer and adaptive effect about ewe fertility

