A multicriteria method to evaluate the resilience of grass-based dairy systems to climate change in Brittany

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Introduction

- Brittany is the main dairy region in France *(Agreste, 2021)*
- Dairy farms with > 40% maize in forage area are dominant, but low input grass-based systems are more sustainable *(Allard et al., 2002; Acosta-Alba et al., 2012; Martel et al., 2016)*

- Climate change is putting forage production at risk *(Ligneau et al. 2019)*
- Crop diversification is identified as a major strategy for increasing resilience to climate change *(Bowles et al., 2020)*

=> Are grass-based dairy systems less resilient to climate change than farms based on more diversified forage resources ?

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Materials and methods

- Collaborative research project with a group of grass-based dairy farmers (CEDAPA)
- Common definition of resilience, criteria and indicators to measure it
- Creation of a multicriteria method for assessing resilience
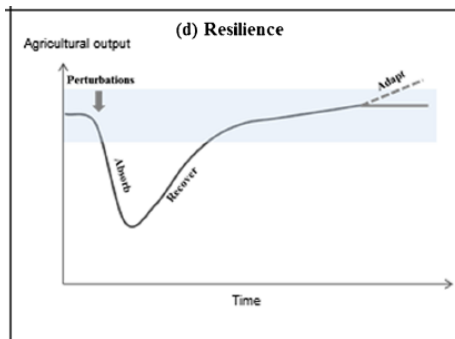- Test of the method in 29 dairy farms with various forage systems
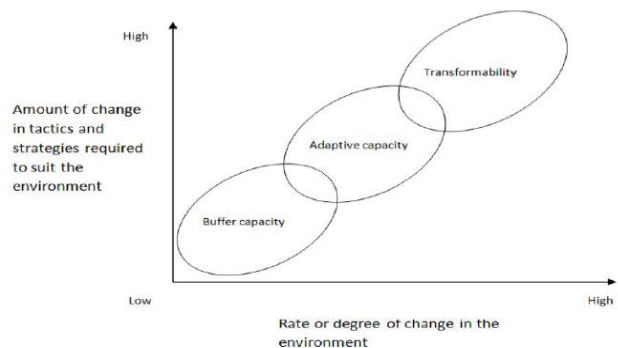
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Resilience

Resilience is "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks" *(Walker et al. 2004)*
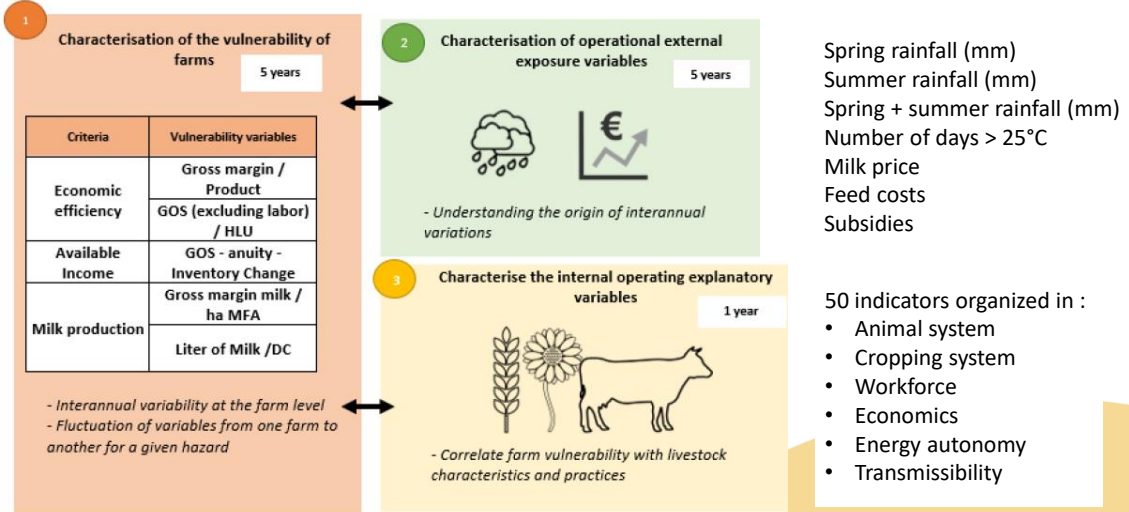

(Urruty et al., 2016)

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(Walker, 2004; Folke et al., 2010)

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The method

Spring rainfall (mm)
Summer rainfall (mm)
Spring + summer rainfall (mm)
Number of days > 25°C
Milk price
Feed costs
Subsidies

50 indicators organized in :
- Animal system
- Cropping system
- Workforce
- Economics
- Energy autonomy
- Transmissibility

(From Martin et al., 2017)

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Sample description (n=29)

Less maize, less inputs, less milk than reference systems

more gross operating surplus

|	FADN data (2018-2019)	Group average (2019-2020)
Number	92	29
UAA	87,50	79,70
MFA	65,10	67,75
%MFA/UAA	78,00%	86,27%
HLU	1,80	1,99
% of corn in the MFA	37,35%	15,57%
Livestock density	1,70	1,21
Number of dairy cow	72.00	67,83
Milk Sold	499 523 L	351 728 L
Milk Sold / Dairy cow	6 846 L	5 067 L
Feed cost / 1000L	139,00 €	48,15 €
Mechanization Cost /ha	834,00 €	516,12 €
Gross Operating Surplus (GOS)	71 737,00 €	96 402,00 €
GOS / 1000L sold	134,00 €	298,67 €

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No interannual difference in vulnerability...

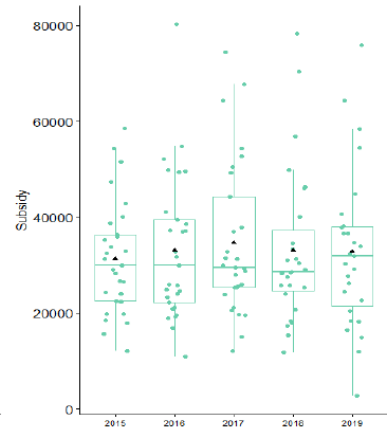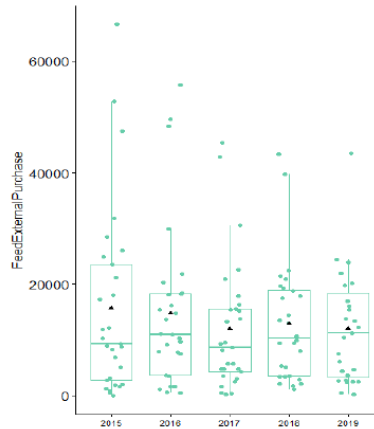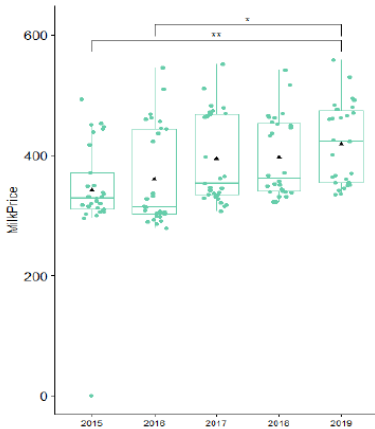Gross margin · Gross operating surplus · Income · Milk margin / ha · Milk production per cow
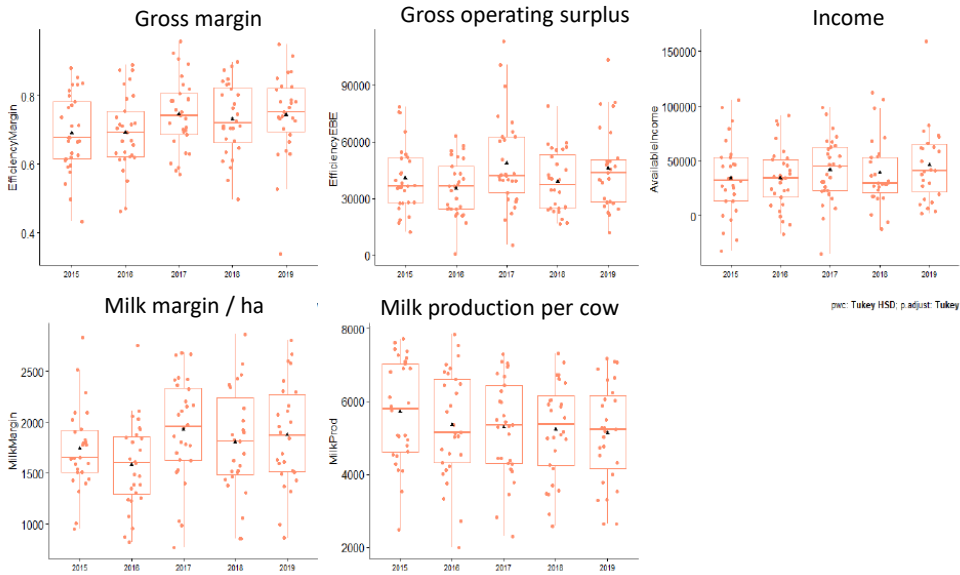
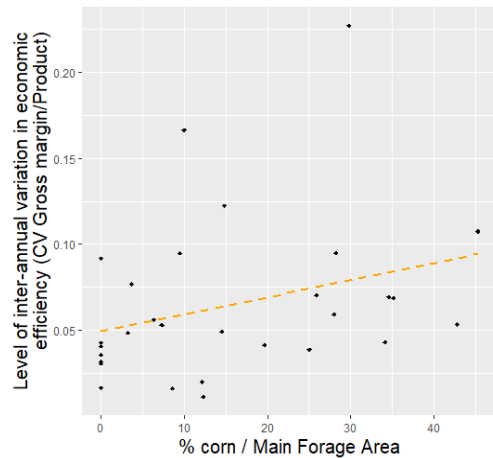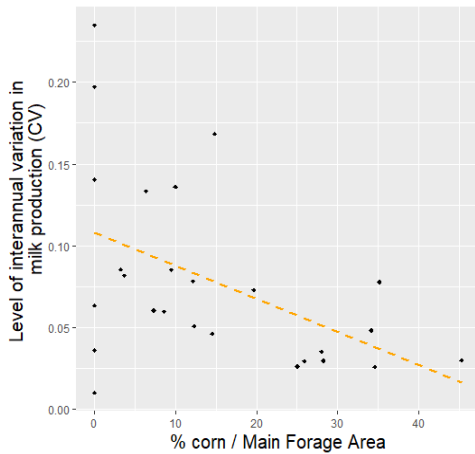# ... while significant climatic variations
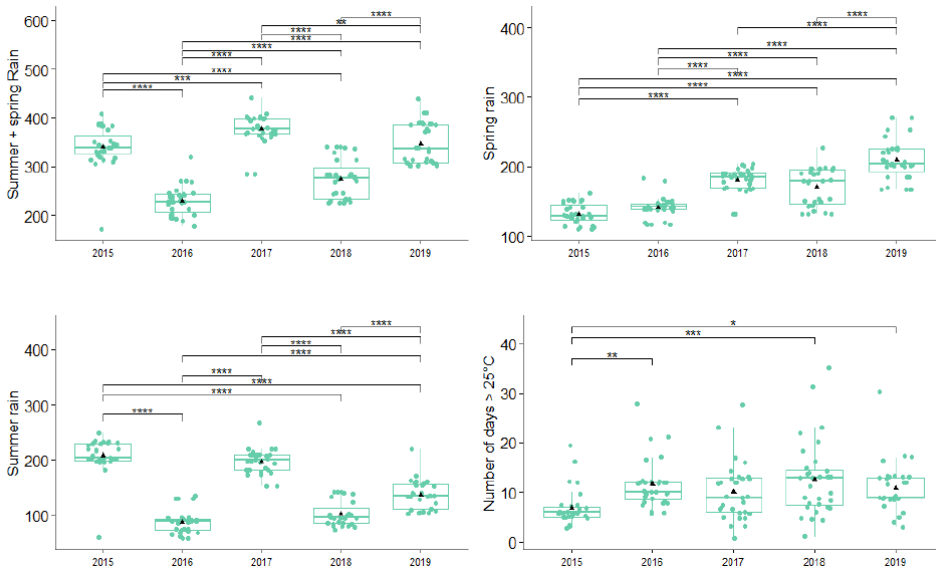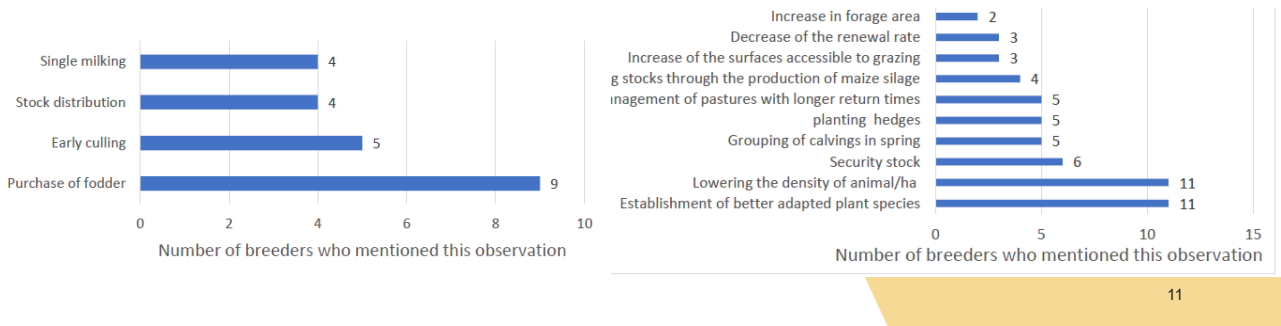
... and milk price variations

Are grass-based systems less resilient? It depends

To summarize

- Sampled farms not affected by climatic and economic variations
- Grass based farms seem to accept more milk production variations but have a higher and more stable economic efficiency and gross operating surplus
- Climatic and economic stresses not important enough?
- Buffer capacity and adaptation levers are already implemented

Number of breeders who mentioned this observation (left chart):

Observation	Number
Single milking	4
Stock distribution	4
Early culling	5
Purchase of fodder	9

Number of breeders who mentioned this observation (right chart):

Observation	Number
Increase in forage area	2
Decrease of the renewal rate	3
Increase of the surfaces accessible to grazing	3
g stocks through the production of maize silage	4
management of pastures with longer return times	5
planting hedges	5
Grouping of calvings in spring	5
Security stock	6
Lowering the density of animal/ha	11
Establishment of better adapted plant species	11

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Perspectives

- Great interest of farmers about resilience as a multidisciplinary concept
- Simplify the method to make it more user friendly for advisors
- Couple it with a sustainability assessment to be able to explore the potential trade-offs between sustainability and resilience

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Thank you for your attention

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