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Adaptation strategies of dairy women cooperatives to climate change in Benin, Niger, Burkina-Faso and Mali (West Africa)

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Relevance of this research

- ❑ In many West African countries, dairy production has become vulnerable due to climate variability and increasing milk production is currently a major concern. (Oudet, 2005; Millogo et al, 2018).
- ❑ In Burkina Faso as in most west Africa countries, milk production is higher during the rainy season compare to dry season (Ouédraogo et al, 2016).
- ❑ In Benin, the low level of milk productions forces Benin to import about 40,000 tons of milk per year, which results in loss of foreign exchange estimated at 10 billion FCFA each year (FAO, 2012).
- ❑ Several studies indicate economic loss resulting from spoilage of milk due to increasing temperature (Aklilu et al., 2013). The quantity of sour milk is increasing every year in spite of various efforts to reduce it (Millogo et al., 2018).

Aims

Building resilience for adaptation to climate change in milk sector and among dairy women cooperatives in West Africa

- ❑ To understand the Perception and Adaptation Strategies of dairy farmers towards Climate Variability and Change
- ❑ To assess the dynamic of pastoral resources across various climate regions in West Africa
- ❑ To evaluate the Variation of Nutritional and Microbiological Properties of milk in relation to climate adaptation strategies across dairy production systems
- ❑ To analyze the impact of climate adaptation systems on economic viability of dairy women cooperatives



Research activities and main findings

Methodology/Research activities

- 1/ Field work, surveys and focus groups discussion → Perception and Adaptation Strategies of dairy farmers
- 2/ Milk sampling and Laboratory work → Variation of Nutritional and Microbiological Properties of milk in relation to climate adaptation strategies across dairy production
- 3/ Surveys and discussion with women dairy cooperatives responsables → Economic Viability of Dairy Women's Cooperatives in Changing Climate in West Africa
- 4/ Use of Meteo agencies and open GIS data → Dynamic of pastoral resources across various climate regions in West Africa
- 5/ Results dissemination and training → Community engagement

Perception and Adaptation Strategies of dairy farmers towards Climate Variability and Change in West Africa

Paper under consideration in Climatic change journal



Perception and Adaptation Strategies of dairy farmers towards Climate Change in West Africa

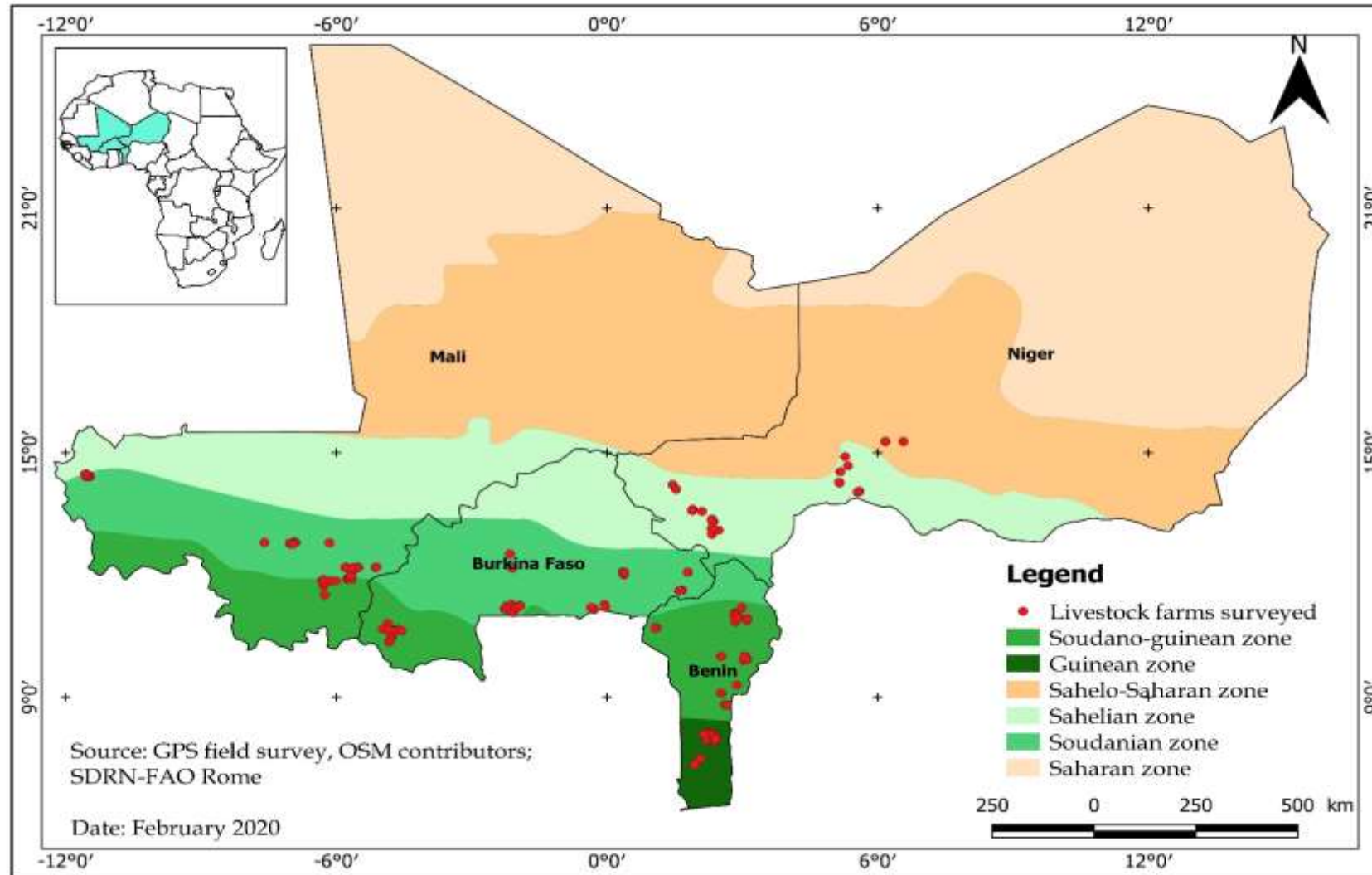


Figure 1: Study areas

Perception and Adaptation Strategies of dairy farmers towards Climate Change in West Africa

Table 1: Distribution of respondents in the study area

Country	Climate zones	Number of District	Sample size
Benin	Guinean	1	60
	Sudano-Guinean	3	180
	Sudanian	2	120
Burkina Faso	Sudanian	1	60
	Sudano-Sahelian	2	120
Mali	Guinean	1	60
	Sudanian	1	60
	Sahelian	1	60
Niger	Sahelian	2	120
	Sahelo-Saharan	1	60

900 respondents were sampled with 60 dairy farmers per rural district

Perception and Adaptation Strategies of dairy farmers towards Climate Change in West Africa

2. Typology of adaptation strategies

Climate-related constraints : Livestock feeding in dry season, Improve the nutritional quality of poor fodder, Water access in dry season, Milking methods, Control milk quickly fermentation in warm environment

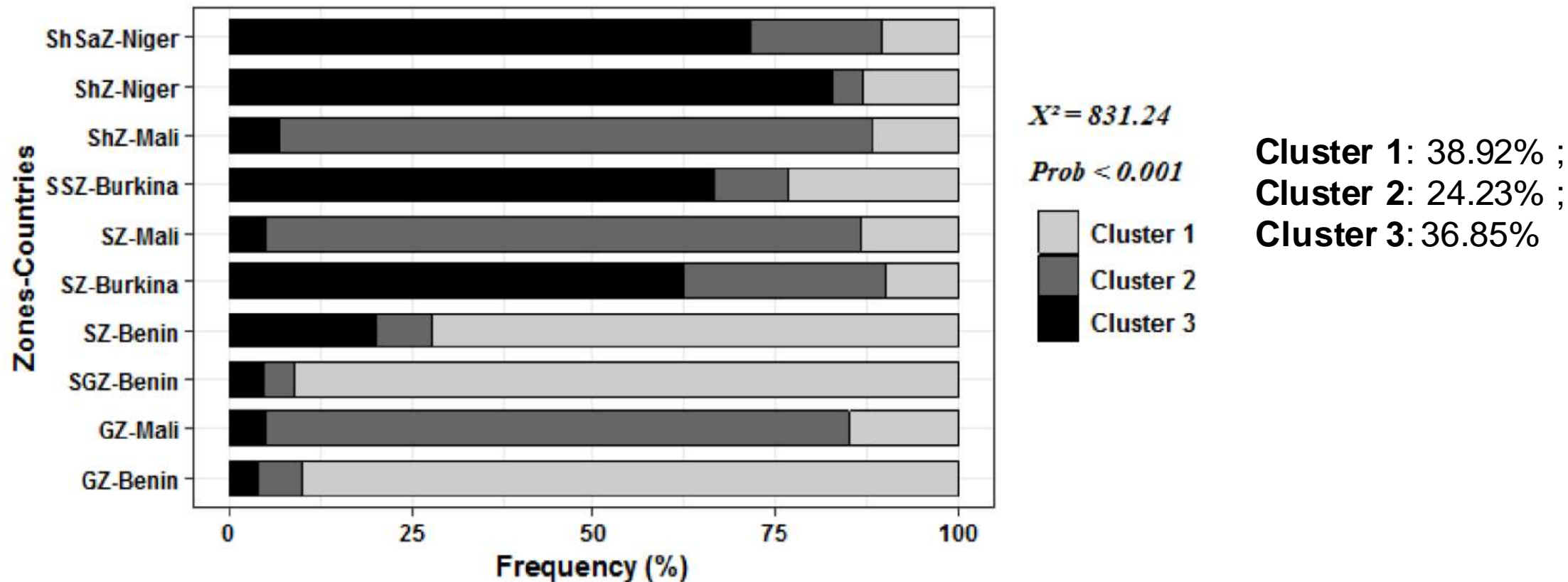


Figure 2. Relation between cluster of adaptation system, climatic zones and countries

Climate-related constraints	Adaptation system 1	Adaptation system 2	Adaptation system 3
Livestock feeding in dry season	Crops residues and agroindustrial by-products	Transhumance to wetlands	Fodder production, silage technology
	Transhumance to wetlands	Straw + Mineral lickstones	Herd size reduction
	-	-	Herd diversification with sheep and goats
Improve the nutritional quality of poor fodder	Supplements based on oil-cakes or multinutritional blocks	Adding salt to the dairy cows ration	Fodder treatment with urea
Water access in dry season	Natural water supplies (streams, rivers, marshes, wetlands...)	Sinking boreholes and wells in dry places	Collective pastoral wells
	Rainwater harvesting system		Purchase water at the village public water pump
Milking methods	Handmilking in calabashes based on wood of <i>Pterocarpus lucens</i> , <i>Acacia nilotica</i> et <i>Balanites aegyptiaca</i>	Handmilking in plastic containers	Handmilking in aluminium containers
Milk conservation/ Control milk quickly fermentation	Flash pasteurization of milk with nectar extracted from some plants	Flash pasteurization of milk	Flash pasteurization of milk with sodium bicarbonate

Perception and Adaptation Strategies of dairy farmers towards Climate Change in West Africa

3. Relationships between dairy farming systems and adaptation strategies

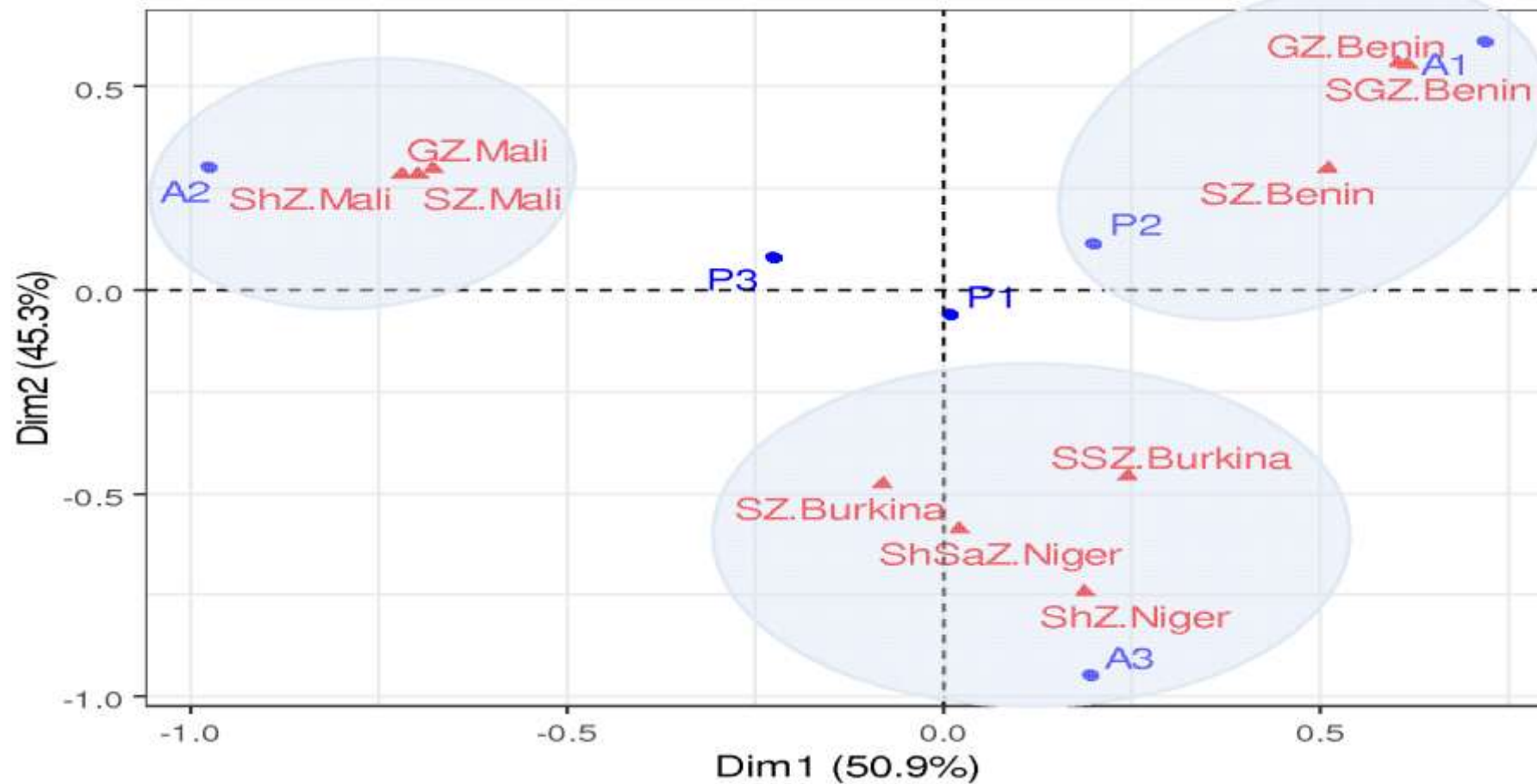
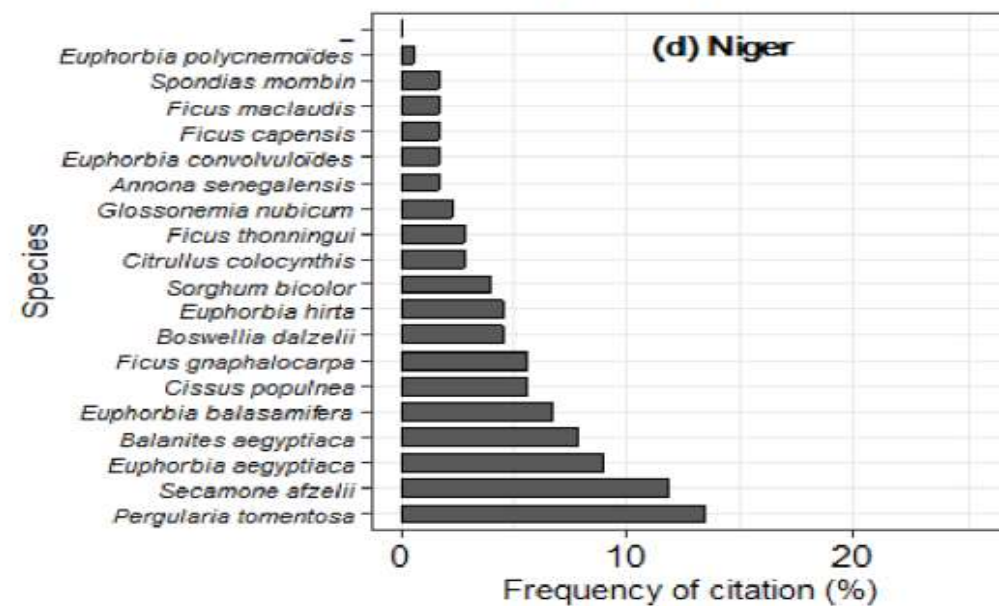
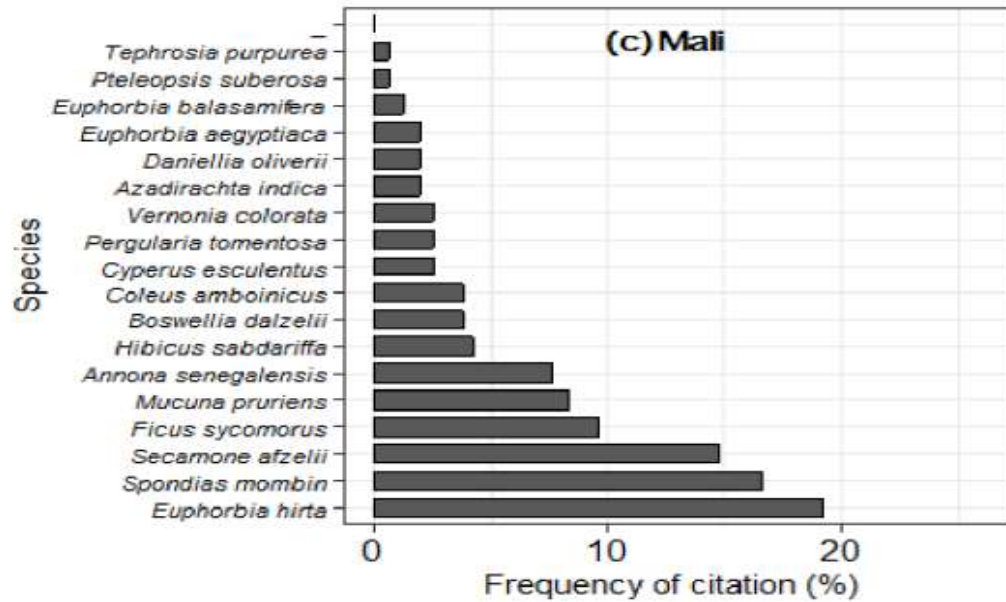
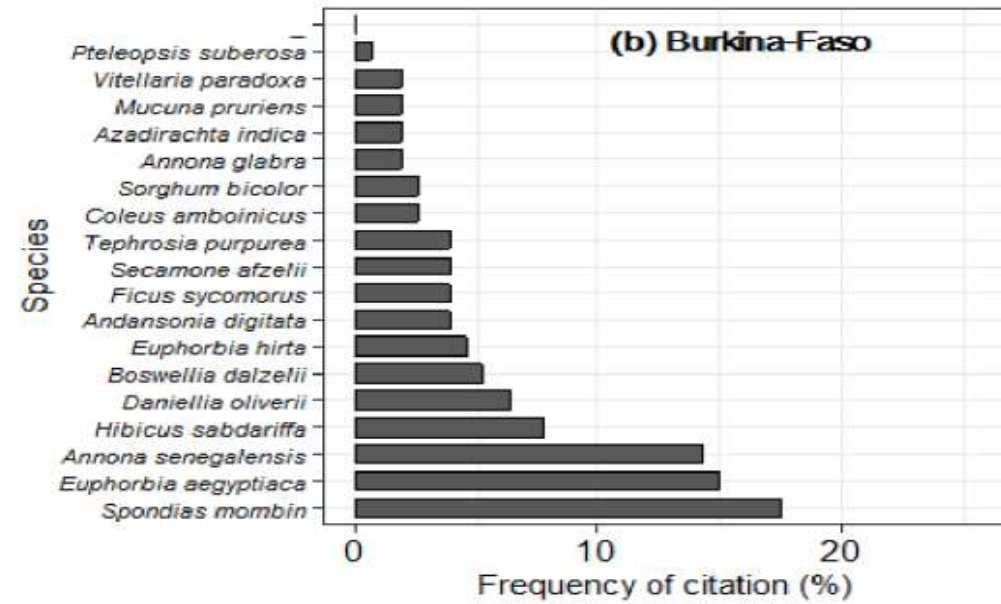
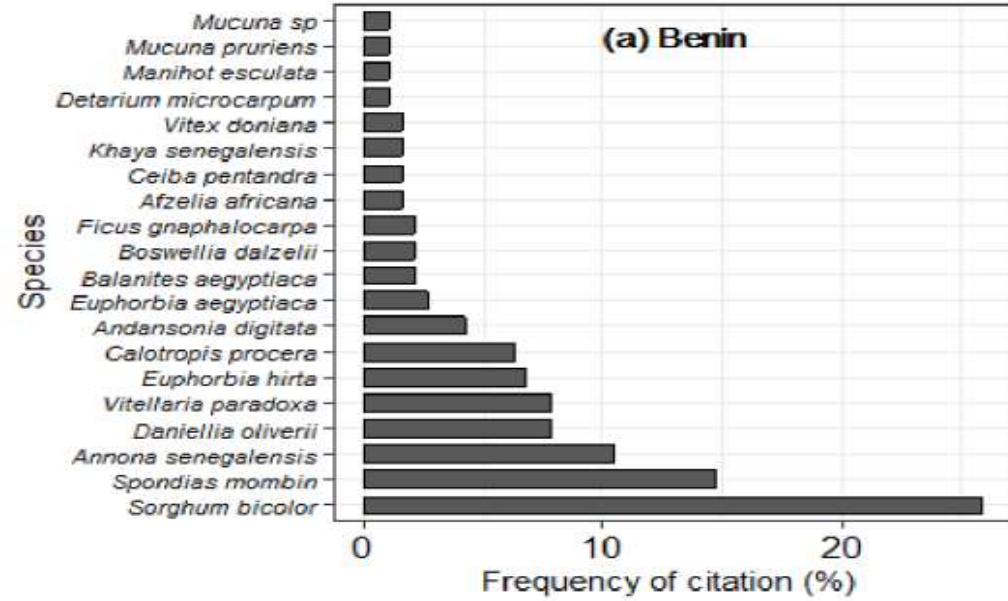


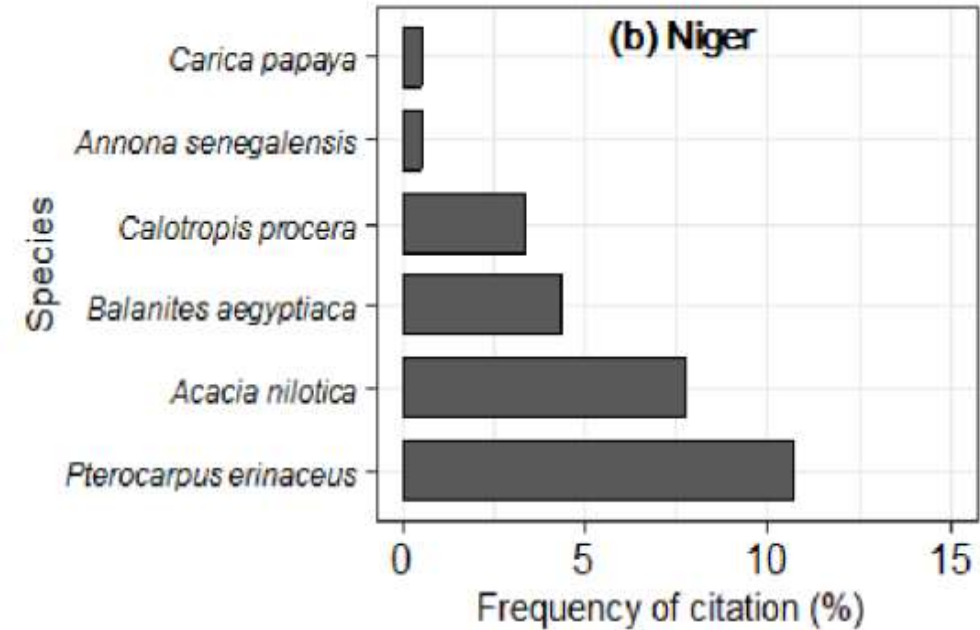
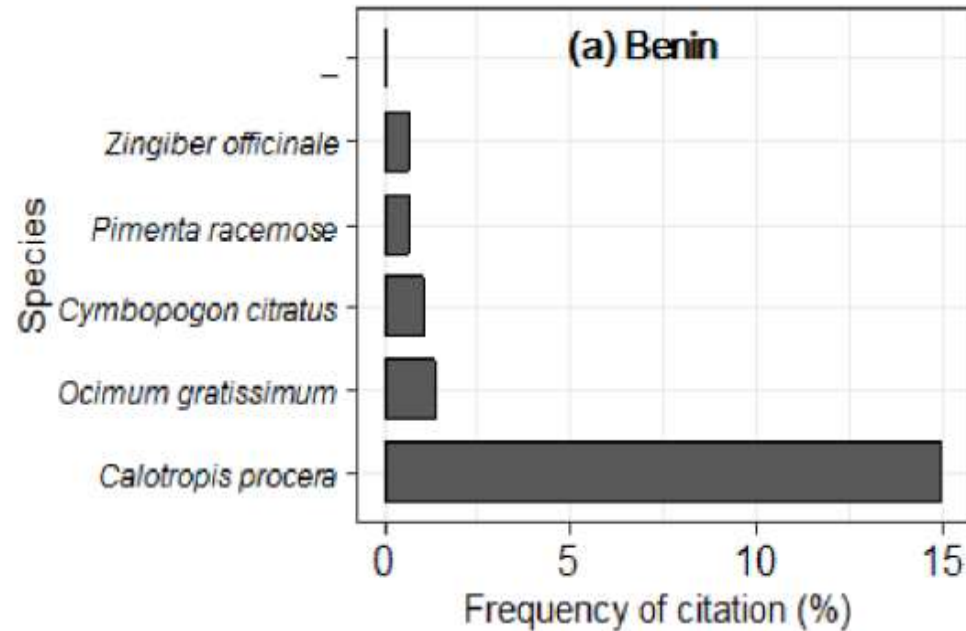
Figure 3. Correspondence factor analysis on the relationship between production and adaptation systems

Galactogenics plants used to feed dairy cows/ Milk quantity



A

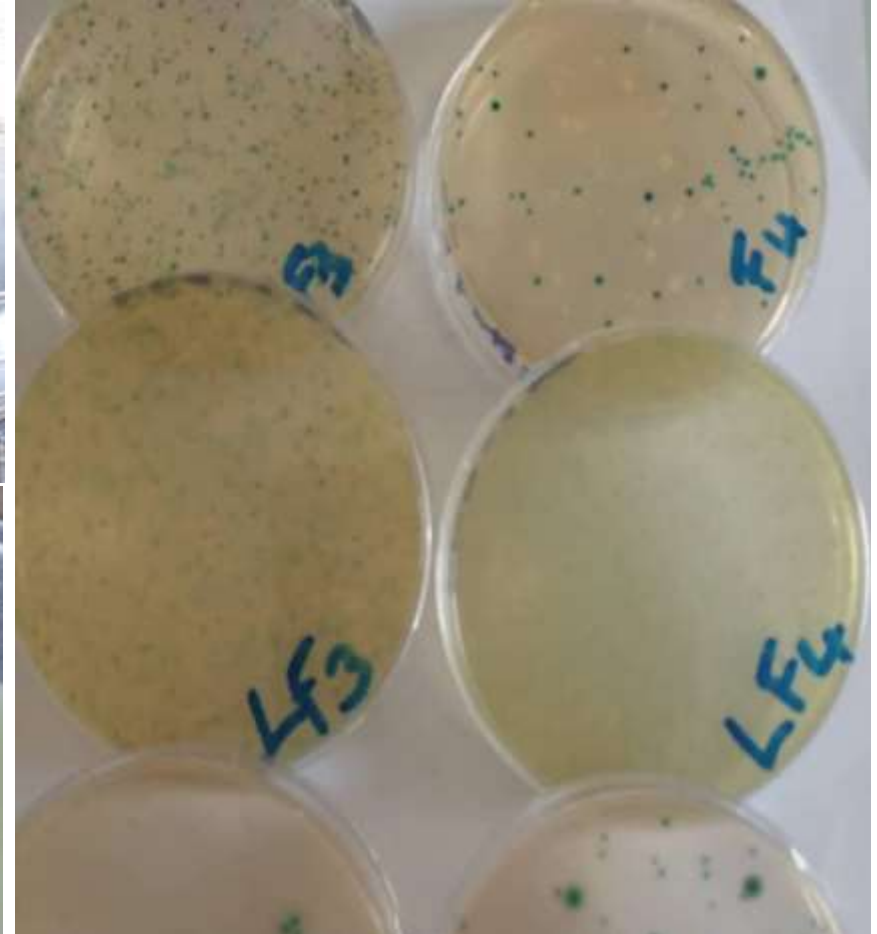
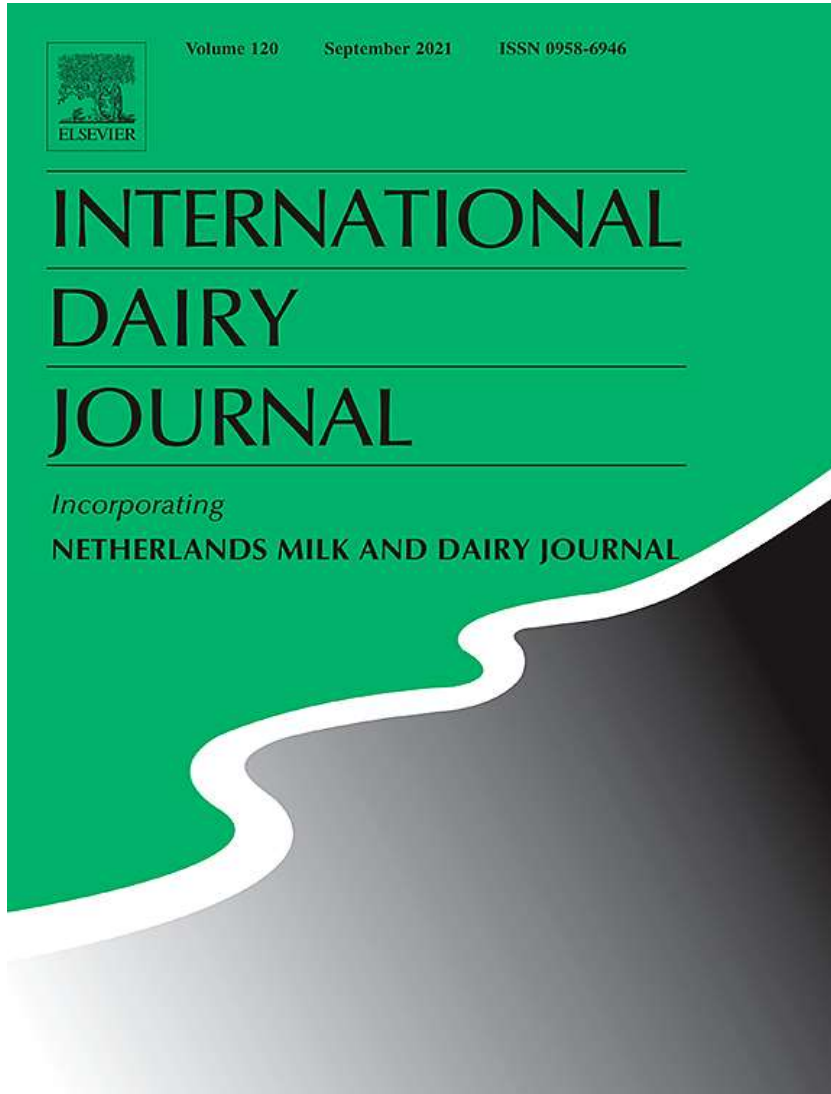
Plants used to control rapid fermentation of the milk



B

Variation of Nutritional and Microbiological Properties of milk in relation to climate adaptation strategies across dairy production systems

Paper has published in International Dairy Journal,



Variation of Nutritional and Microbiological Properties of milk

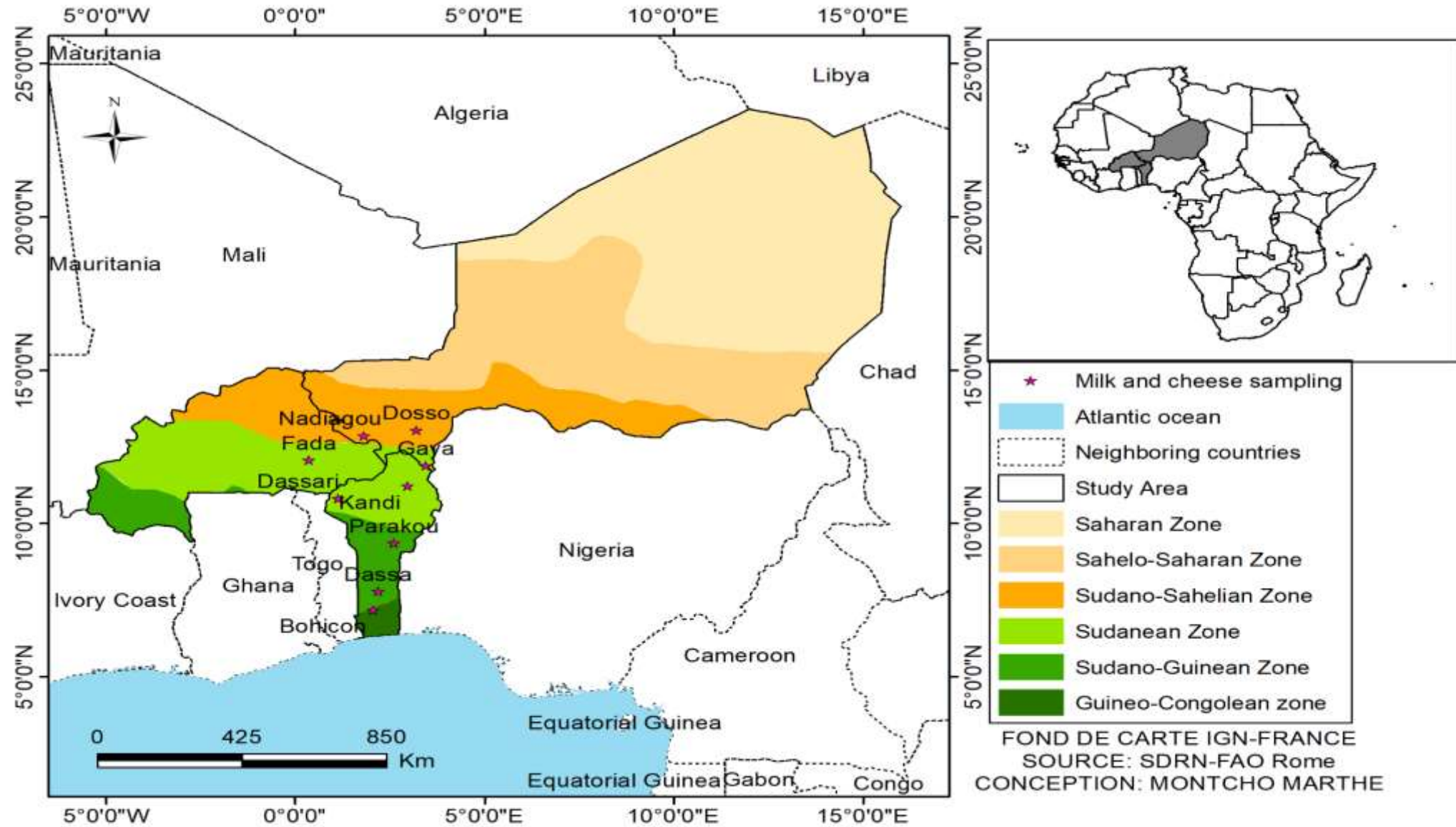
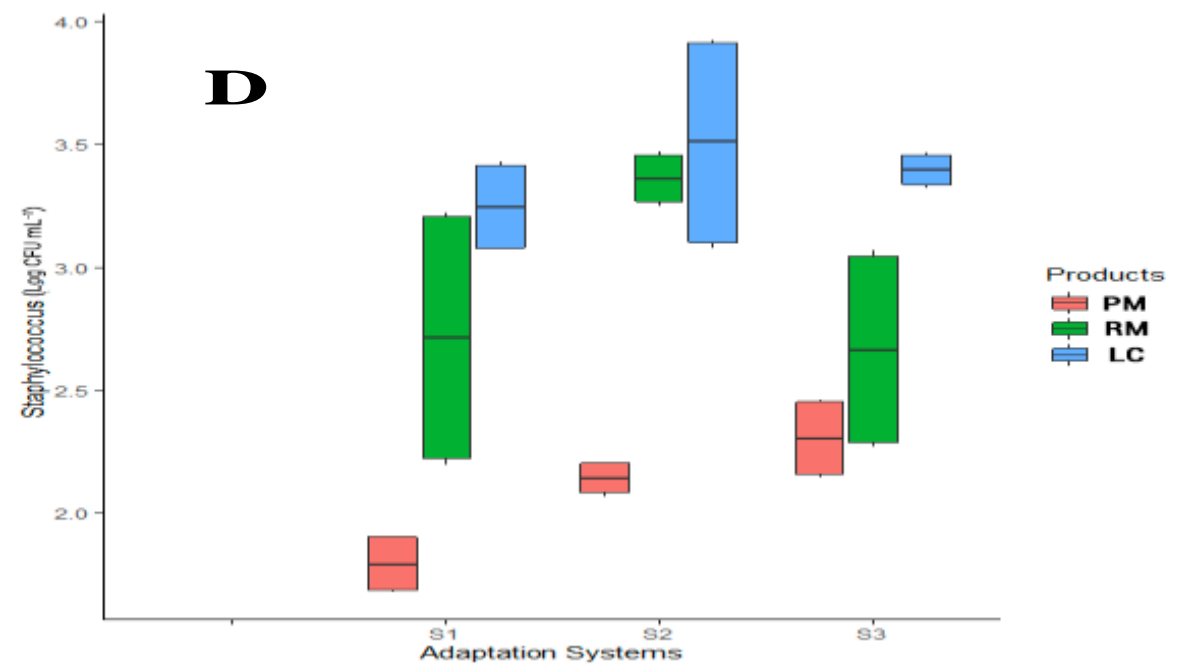
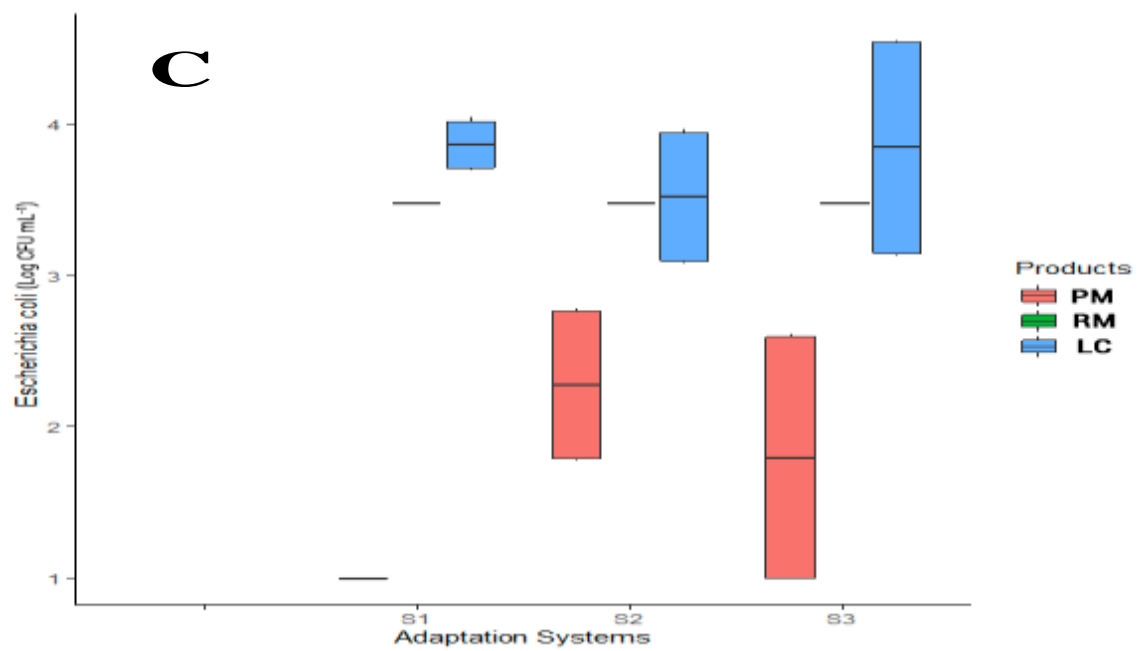
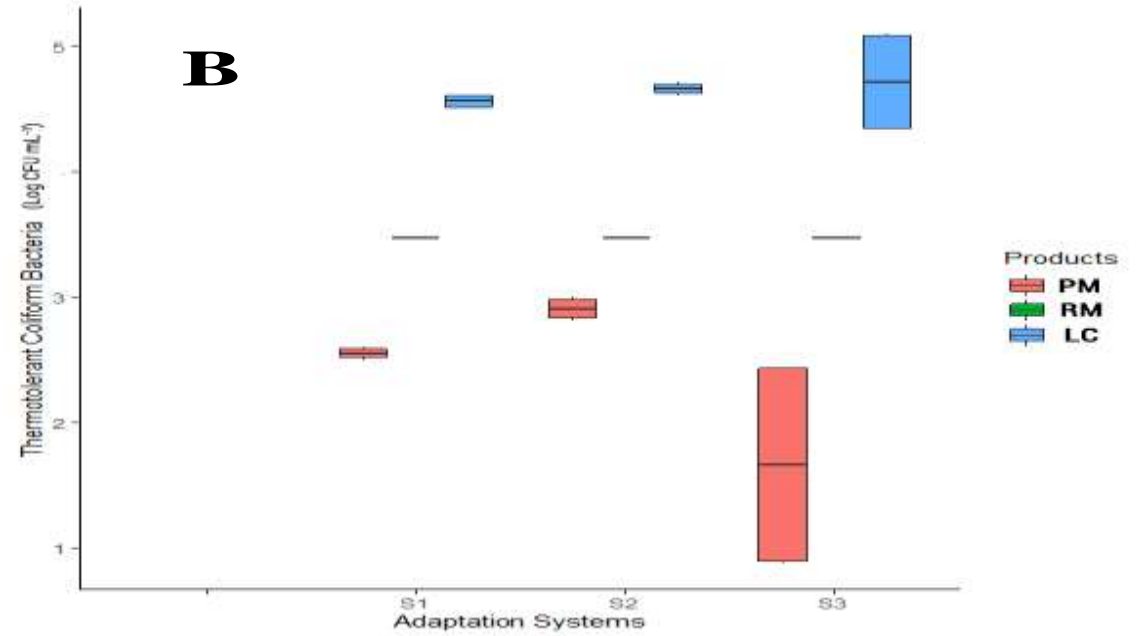
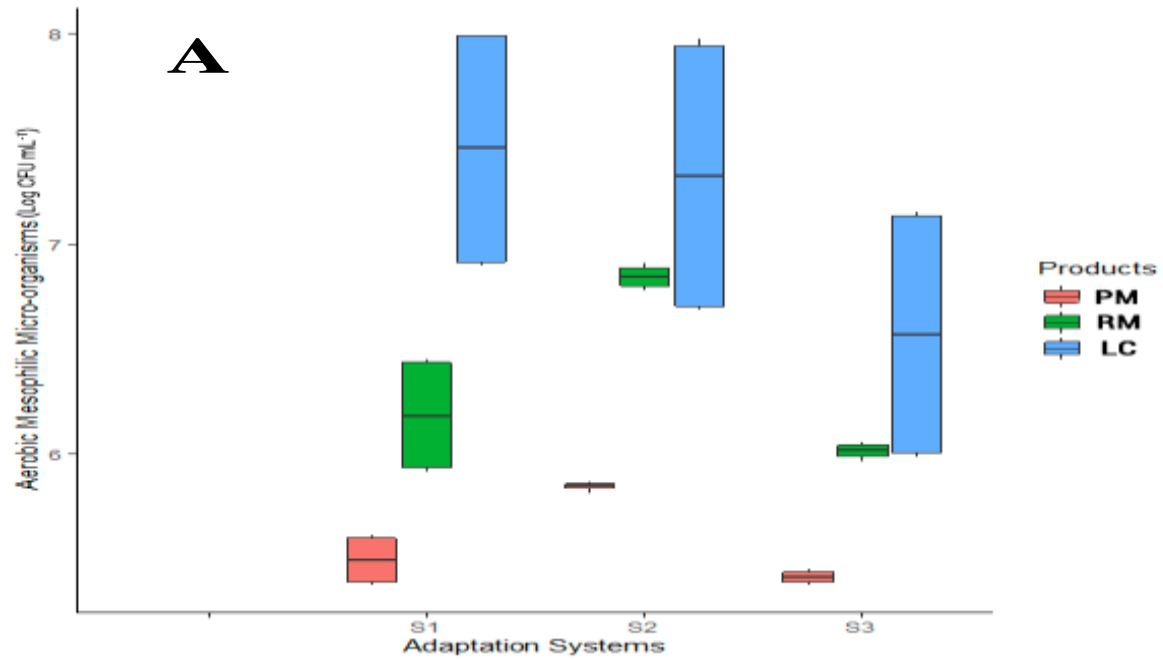
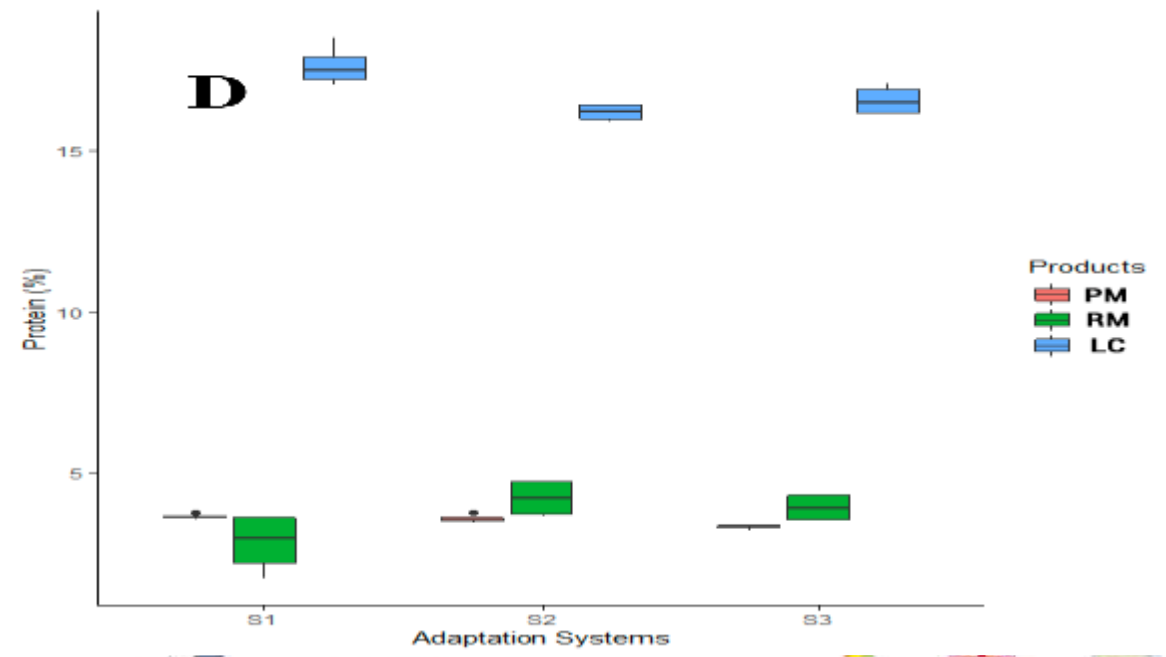
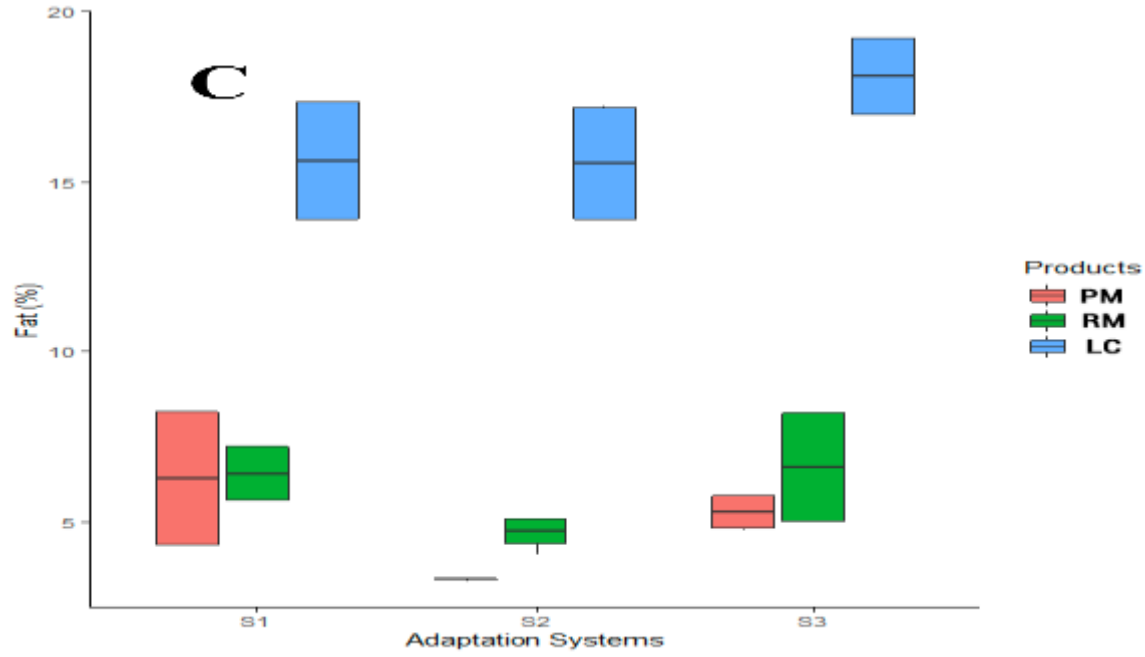
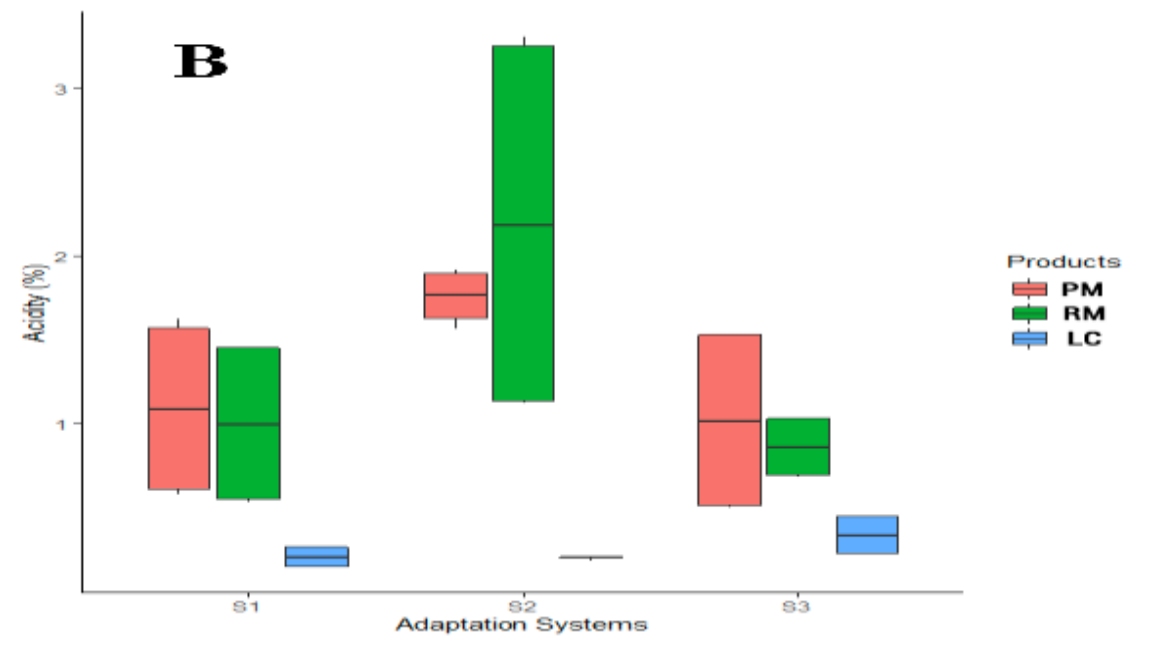
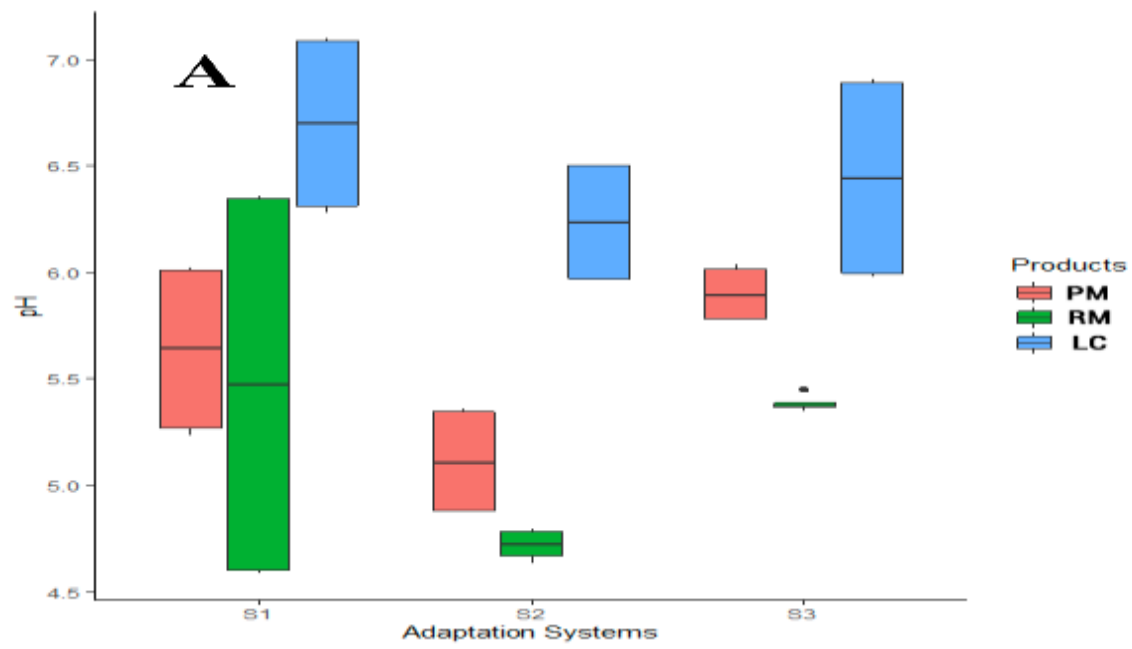
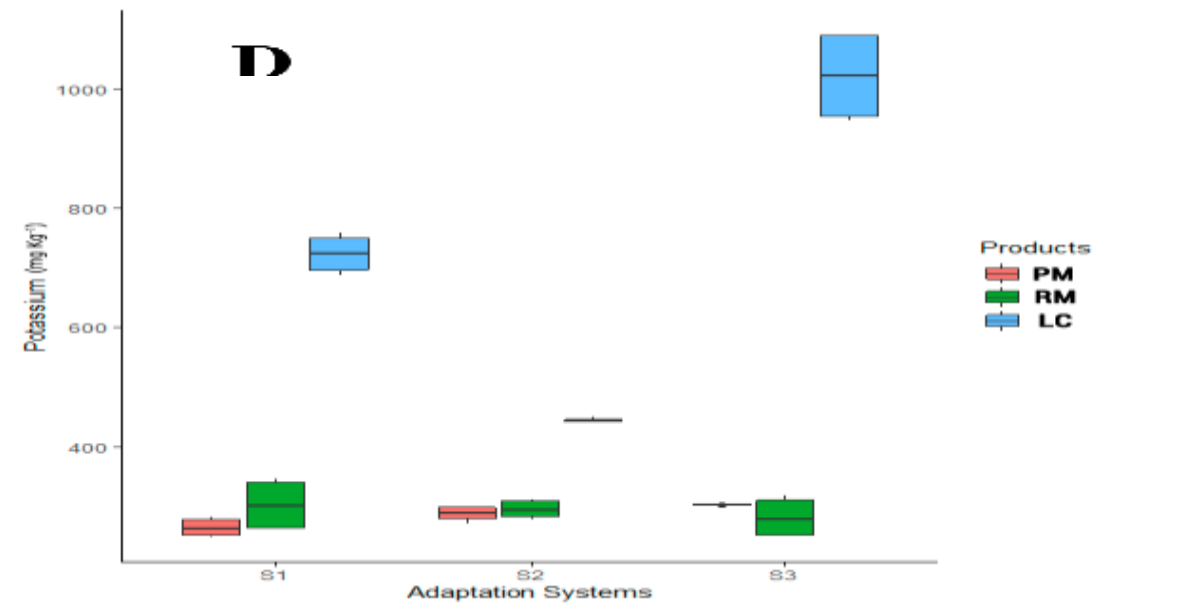
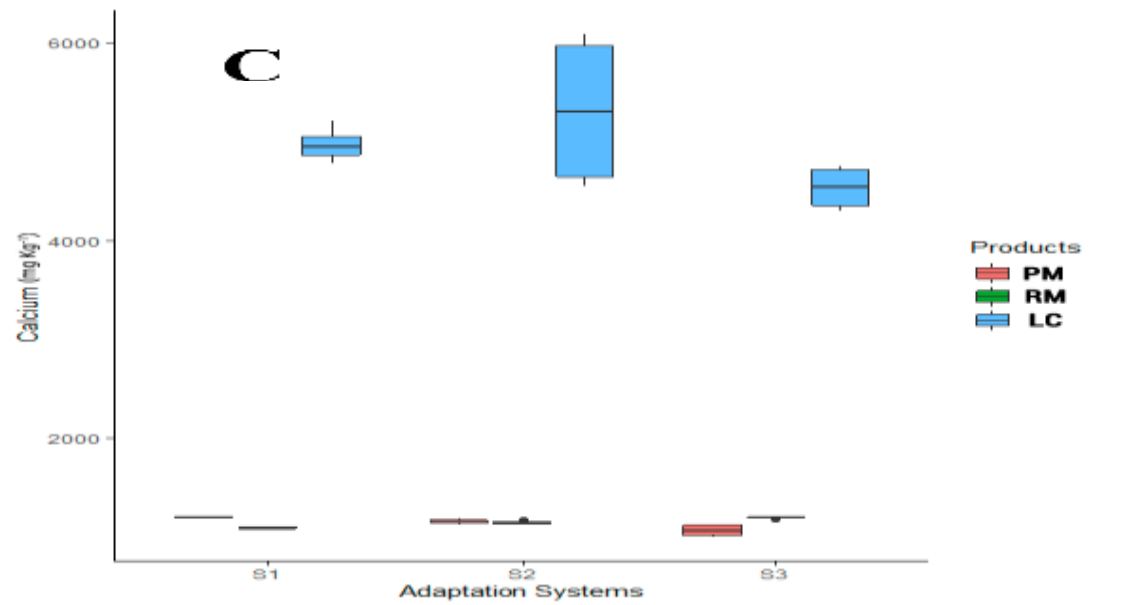
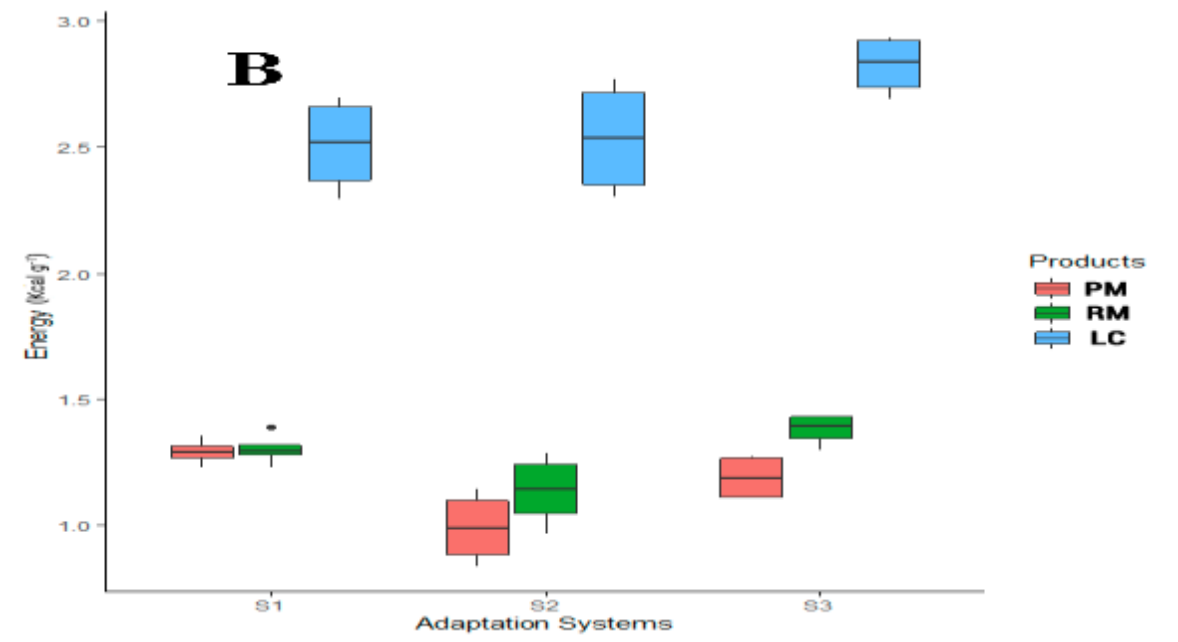
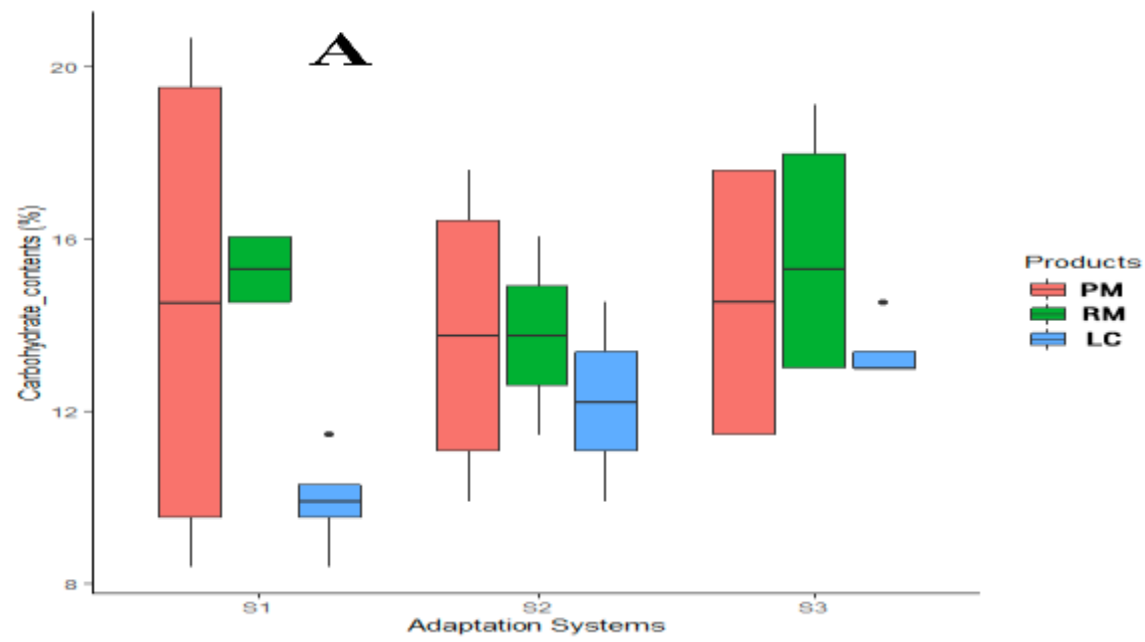


Figure 1. Study area and sampling sites in Benin, Burkina Faso and Niger







Economic Viability of Dairy Women's Cooperatives in Changing Climate in West Africa

Paper published in the Acts of "Women and Development in Sub-Saharan Africa" Scientific symposium, July 2021, Abidjan, Ivory coast



Economic Viability of Dairy Women's Cooperatives

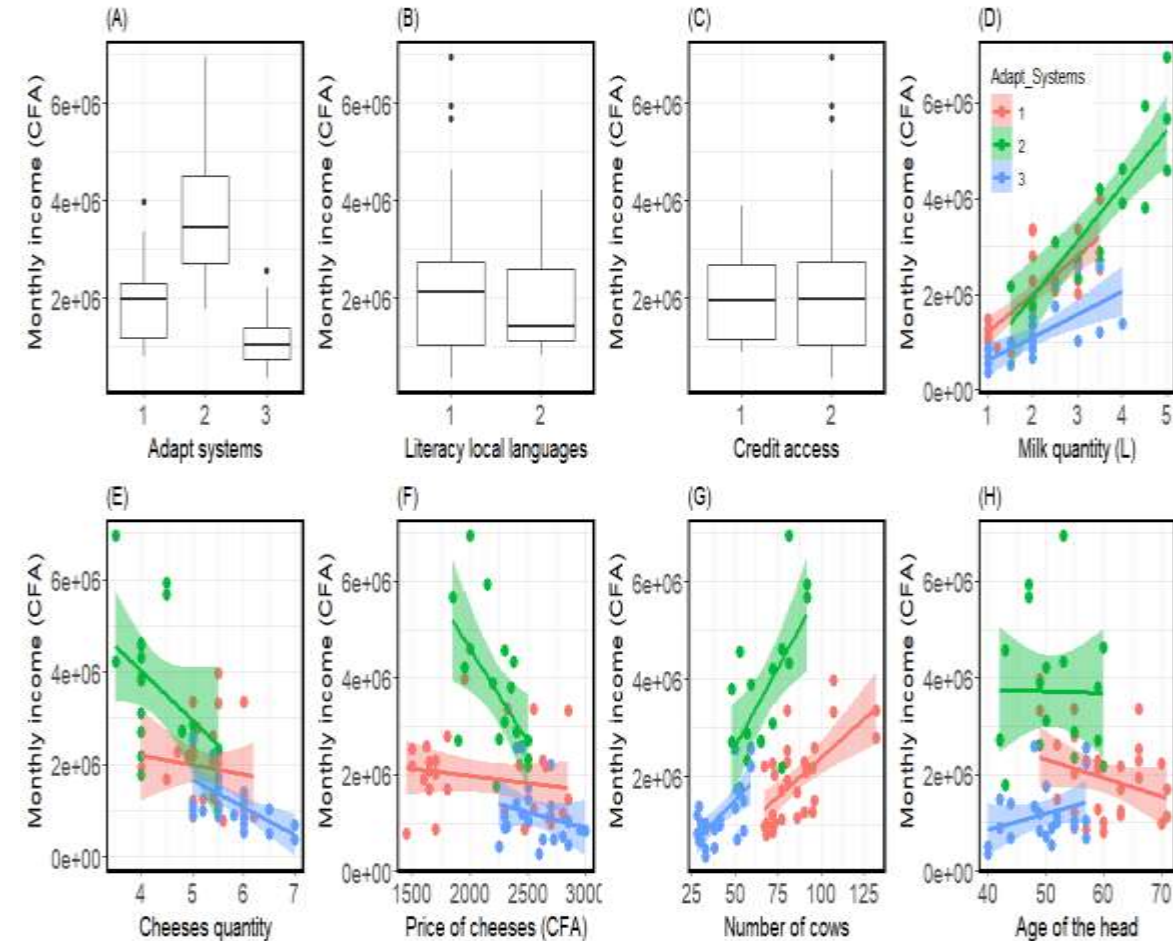
Table . Correlations between economic parameters and cooperatives operating characteristics variables.

	MI	Milk	C	PM	PC	HS	NC	YE	NP	AH
MI		0.76	-0.69	-0.57	-0.42	0.53	0.5	0.16	0.25	-0.02
Milk	<0.001		-0.48	-0.54	-0.51	0.05	-0.01	-0.15	0.02	-0.21
C	<0.001	<0.001		0.58	0.5	-0.31	-0.31	-0.02	-0.14	-0.11
PM	<0.001	<0.001	<0.001		0.89	-0.49	-0.49	-0.38	-0.21	-0.23
PC	0.0003	<0.001	<0.001	<0.001		-0.36	-0.36	-0.28	-0.17	-0.14
HS	<0.001	0.6783	0.0099	<0.001	0.0024		0.94	0.67	0.42	0.34
NC	<0.001	0.9249	0.01	<0.001	0.0025	<0.001		0.69	0.45	0.39
YE	0.183	0.2288	0.8383	0.0013	0.0197	<0.001	<0.001		0.61	0.51
NP	0.0336	0.8478	0.2615	0.0763	0.1502	0.0002	0.0001	<0.001		0.27
AH	0.8563	0.0776	0.368	0.0506	0.2509	0.004	0.0008	<0.001	0.0233	

Monthly Incomes (MI, in CFA), M= (Milk in Liter), C= (Cheese, in Kg), PM= (Price Milk, in CFA), PC= (Price Cheese in CFA), HS= Herd size, NC=Number cows, YE= Years existence, NP=Number persons, AH=Age of head

Predictors	Estimate	SE	t value	Pr(> t)
Intercept	14.404	0.053	271.8	<0.0001***
Adapt Systems 2	0.139	0.064	2.167	0.035055*
Adapt Systems 3	0.200	0.069	2.898	0.005567**
Credit access 2	0.057	0.038	1.511	0.1372
Literacy local languages 2	0.070	0.035	2.025	0.048231*
Adapt Systems 1 x Milk	0.589	0.027	21.912	<0.0001***
Adapt Systems 2 x Milk	0.333	0.025	13.102	<0.0001***
Adapt Systems 3 x Milk	0.461	0.029	15.9	<0.0001***
Adapt Systems 1 x Cheeses	-0.181	0.031	-5.853	<0.0001***
Adapt Systems 2 x Cheeses	-0.123	0.034	-3.682	0.0006***
Adapt Systems 3 x Cheeses	-0.141	0.031	-4.509	<0.0001***
Adapt Systems 1 x Price of Cheese	0.185	0.017	10.702	<0.0001***
Adapt Systems 2 x Price of Cheese	0.121	0.060	2.01	0.0498*
Adapt Systems 3 x Price of Cheese	0.077	0.038	2.006	0.0502
Adapt Systems 1 x Number of cows	0.307	0.025	12.37	<0.0001***
Adapt Systems 2 x Number of cows	0.302	0.041	7.354	<0.0001***
Adapt Systems 3 x Number of cows	0.567	0.049	11.521	<0.0001***
Adapt Systems 1 x Age of head	0.029	0.023	1.239	0.2213
Adapt Systems 2 x Age of head	0.002	0.029	0.081	0.9356
Adapt Systems 3 x Age of head	0.071	0.028	2.503	0.0156*

Table : Summary of the best fitted model to test how relationship between monthly income and socio-economical variables varied with adaptation systems.



OUTPUTS

- ❑ 5 presentations at symposiums, 2 of them physically and 3 by zoom meetings
- ❑ 2 papers published in Peer Review Journals and 2 papers under review
- ❑ Feedback and Research results dissemination
- ❑ Workshop/ validation and consensus on the recommendations and new practices for more resilience among dairy farming systems



Community engagement

- ❑ Training sessions on “**Strengthening the resilience of women's dairy cooperatives and dairy farmers to climate change**”
- ✓ Training session on dairy farm and cattle **feeding technologies** under high climate variability
- ✓ Training session on **new practices and technologies of milk processing and conservation** under warming temperature/ Avoid rapid fermentation of milk

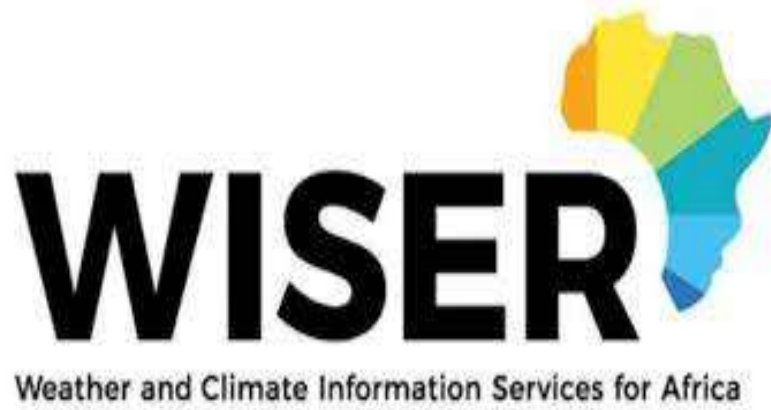


- ✓ Training session on **how to organize dairy cooperative to ensure economic viability** in a changing climate/ best models of economic viability for women dairy cooperatives

Main Challenges

- ❑ Difficult to collect data in some Sahelian regions of Burkina Faso considered as a red zone, not recommended due to terrorist attacks
- ❑ The delay in the implementation of some research activities due to Covid19

Acknowledgement



Thank you for your attention

