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What drive the environmental performance of dairy farms ?

A comparative analysis of the adoption of best environmental practices

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INRA SCIENCE & IMPACT

AGIR UMR 1248 INRA / INPT AGroécologie - Innovations - TeRritoires

INP TOULOUSE PURPAN ÉCOLE D'INGÉNIEURS

Sciences du vivant | Agriculture Agroalimentaire | Marketing | Management

Introduction

- Large literature on the adoption of best management practices
  (Prokopy et al., 2008; Baumgart-Getz et al., 2012; Yoder et al., 2019)
- Survey about the adoption of one or two practices and little comparative analysis
- Mainly based on case studies or small sample of farms
- Few studies about the dairy sector

Goals

- Study the determinants of the adoption of best environmental practices
- Consider a large set of farm's environmental practices
- Make a comparative analysis between the practices
- Make an exhaustive analysis of French dairy farms
- Use a theoretical framework that allows to understand the influence of internal and external factors on the adoption of the practices

Analytical Framework

Internal Factors

Individual Characteristics
(Cohen et Levinthal, 1994; Darnhofer, 2014)

Characteristics of the farmer
Education (diploma)
Age
Male

Uncertainty
Known Successor
Subscription to Agricultural insurance

Form of governance and Farm structure (Davies et Hodge, 2006, Van der Ploeg, 2008)

Farm Governance
Legal Status: Individual Property, Partnership farms, Holdings/Firms/other companies
Owned land
Family work

Fam structure
Diversified
Size/Turnover
ICTs - specialized accounting software
ICTs - specialized technical software

Adoption of best environmental practices
BEP

Farm Environmental Performance

External Factors

Regulatory Rennings 2000)

Paid for environmental services

Market (Carriquiry et Babcock, 2007; Raynaud et al., 2009)

Organic
Quality Label
Short market chains

Spatial factors (cluster/spilover)
(Galliano et al., 2015; Vicente et Suire, 2007; Esparcia, 2014)

Agglomeration
Neighbourhood influency
Geographical
Plain ,Disadvantaged, Piedmont, Mountain, High Mountain

Data and Methods

French Agricultural Census (2010)

47211 specialized dairy farms

Comparative analysis of 9 agricultural practices :

- Area of permanent grassland (%)
- Presence of leguminous fodder (Y/N)
- Area without synthetic fertilizers (%)
- Area without chemicals (%)
- Presence of agro-ecological structures (wood, line of trees, hedges) (Y/N)
- Treatment of manure (Y/N)
- Conservation tillage/No-till (Y/N)
- Non-use of irrigation (Y/N)
- Crop rotation (Y/N)

Econometric approach (correlation)

Linear regressions (quantitative variables) and probit models (qualitative variables)

p-values : * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Results

	Permanent grassland	Leguminous fodder	Non-synthetic fertilizers	Non-Chemical crop protection	Agroecological structures	Treatment of manure	Conservation tillage/No-till	Non- Irrigation	Crop rotation
FACTEURS INTERNES									
Characteristics of the farmer									
Education (diploma)	-0.032***	0.0096	-0.00084	-0.0035*	0.066***	0.058***	0.14***	-0.033	0.0076
Age	-0.00049***	-0.0016*	0.00078***	0.000035	0.0055***	0.0020***	0.0017**	-0.0017	-0.00031
Male	0.016***	0.0016	0.013***	0.019***	-0.069***	-0.072***	-0.062***	0.14***	-0.033*
Uncertainty									
Known Successor	0.016***	0.018	-0.0015	0.00085	0.0054	-0.021	-0.069***	0.099***	-0.055***
Subscription to Agricultural insurance	-0.017***	-0.17***	-0.044***	-0.014***	0.15***	0.072***	-0.13***	-0.018	-0.11***
Farm Governance									
Legal Status: Individual Property	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Partnership farms	-0.032***	0.18***	0.038***	0.019***	0.0093	0.11***	0.15***	-0.40***	0.015
Holdings/Firms/Others	-0.054***	0.079***	0.0070**	-0.014***	0.081***	0.068***	0.14***	-0.20***	0.031*
Owned land	-0.044***	-0.092***	0.0082*	0.014***	0.46***	0.031	-0.0100	0.055	-0.035
Family work	-0.0026	-0.074**	-0.024***	-0.0031	-0.064**	-0.15***	-0.10***	0.16***	0.076**
Fam structure									
Diversified No	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Yes (without dairy)	0.0037	0.091***	-0.0078	-0.016***	0.056**	0.066***	0.037	-0.0039	-0.058**
Yes (dairy processing)	0.013*	0.25***	0.043***	0.023***	-0.21***	-0.13***	0.24***	0.13	0.17***
Size/Turnover	-0.061***	-0.16***	-0.12***	-0.13***	0.17***	0.14***	0.098***	-0.19***	-0.13***
ICTs - specialized accounting software	-0.014***	0.080***	0.0040	-0.0067***	-0.060***	0.041***	0.12***	-0.22***	0.068***
ICTs - specialized technical software	-0.0095***	0.053***	-0.0076***	-0.016***	0.039***	0.027**	0.097***	-0.023	0.021
EXTERNAL FACTORS									
Commercial and Regulatory environments									
Organic Conversion No	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Desired	-0.00028	0.16***	0.12***	0.074***	0.11***	0.13***	0.16***	-0.14***	0.051
Yes/under conversion	-0.018***	0.30***	0.56***	0.30***	0.0087	0.43***	0.043	-0.0064	0.82***
Quality label: No	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Yes (except dairy products)	0.0089**	-0.053*	-0.015***	0.0011	-0.020	0.11***	0.018	0.032	-0.0018
Yes (dairy products)	-0.036***	0.11***	-0.0055**	0.0041**	0.14***	0.085***	0.19***	0.063***	0.052***
Commercialization on short market chains: No	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Yes (except dairy products)	0.0070	0.058*	0.013**	0.020***	0.052**	0.11***	-0.029	-0.42***	-0.036
Yes (dairy products)	0.0052	0.041	0.052***	-0.00032	-0.041	0.19***	-0.038	-0.17***	-0.054
Paid for environmental services	0.087***	0.098***	0.11***	0.097***	-0.065***	0.058***	0.025	0.11***	-0.0076
Spatial environment									
Agglomeration rate of dairy farms	-0.0057***	-0.16***	-0.012***	0.042***	-0.12***	0.098***	-0.037***	0.49***	0.10***
Neighbourhood adoption behavior	0.92***	1.99***	0.22***	0.26***	-0.46***	0.95***	0.85***	2.17***	0.74***
Geographical area: Plain	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Disadvantaged	0.023***	0.18***	0.038***	0.061***	0.029	-0.050***	0.068***	-0.61***	0.052**
Piedmont	-0.0057	-0.28***	0.035***	0.12***	0.22***	0.24***	-0.23***	-0.95***	-0.27***
Mountain	-0.026***	-0.053**	0.037***	0.14***	0.26***	0.20***	0.027	-1.04***	-0.075***
High Mountain	-0.017*	1.04***	0.32***	0.18***	-0.87***	-0.057	0.70***	-2.34***	0.47***
N	47211	47211	47211	47211	47211	47211	47211	47211	47211
chi2		7983.8			2617.2	4635.5	3087.7	6472.7	2089,1
r2_p		0.16			0.032	0.055	0.049	0.26	0.036

p-values : * p < 0.10, ** p < 0.05, *** p < 0.01

Source : 2010 French Agricultural Census

MAIN RESULTS AND DISCUSSION

The same drivers can have + and - correlations with the adoption of sustainable practices : it depends of the BEP

Higher level of education is: + to the treatment of the manure, – permanent grassland covering, 0 non-use of synthetic fertilizers

INTERNAL

Uncertainty (related to insurance subscription) is more important than individual features in the adoption of BEP

Insurance Subscription: 8/9*** 6 + & 2 –

Governance Influence in BEP adoption is ambiguous

Significative differences between individual and holdings

Share of owned land and family labor are not highly correlated

Farm size is negatively correlated to the most BEP

Diversification (mainly by dairy processing) is positively correlated to almost all BEP

EXTERNAL

Payment for environmental services has a positive correlation to the adoption

Alternative markets (organic, labeled and short supply chains) are positively correlated with the adoption of the largest part of BEP

Spatial variables (mainly neighborhood adoption behavior) is the most important driver (explanatory factor) of BEP adoption

Mimetic behavior and spillovers effect can explain it

MAIN CONCLUSION

Polices to promote farmer's exchange and to supporting diversification, labeled products and short circuits can further the adoption of environmental practices on dairy farms.

Thank you for your attention

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