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What is the performance of a low-input sheep flock integrated in an agroecological crop farming system?

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Context

1- Reduce pesticide use in cropping systems → catch crops (N leaching, weeds…)

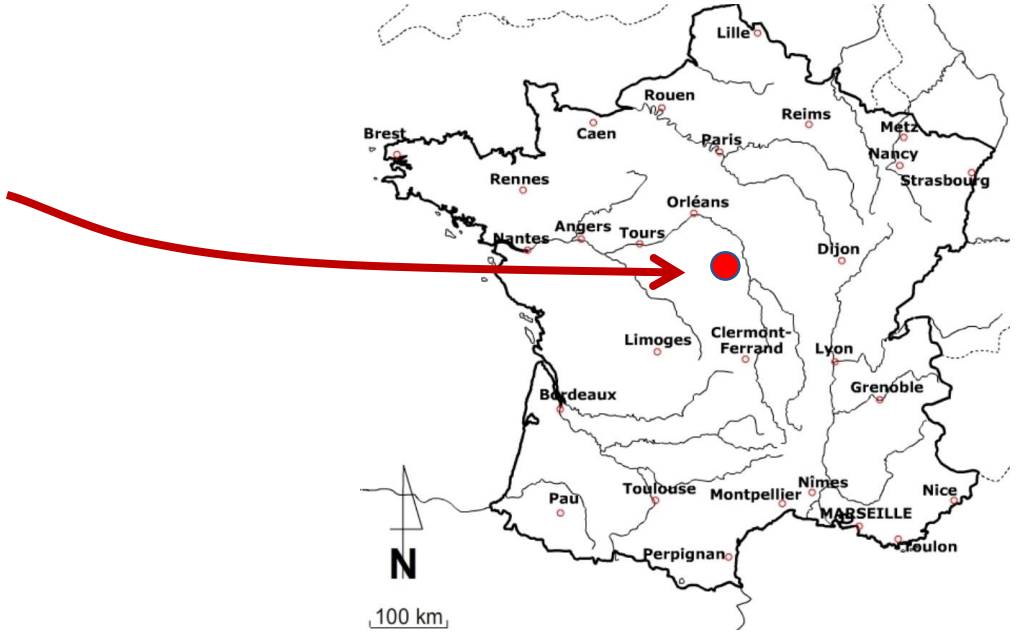
2- Reduce production costs in sheep farming → use co-products

→ Use biomass from catch crops by sheep in mixt crop-livestock farming systems

A research program developed both on an experimental farming system and on private farms

A system experiment. Two-years results.

INRAE experimental farm near Bourges (France)



The system

Main principles

- Lambs fattening: grazing catch crops (= autumn-winter)
  - ➢ Lambing in September

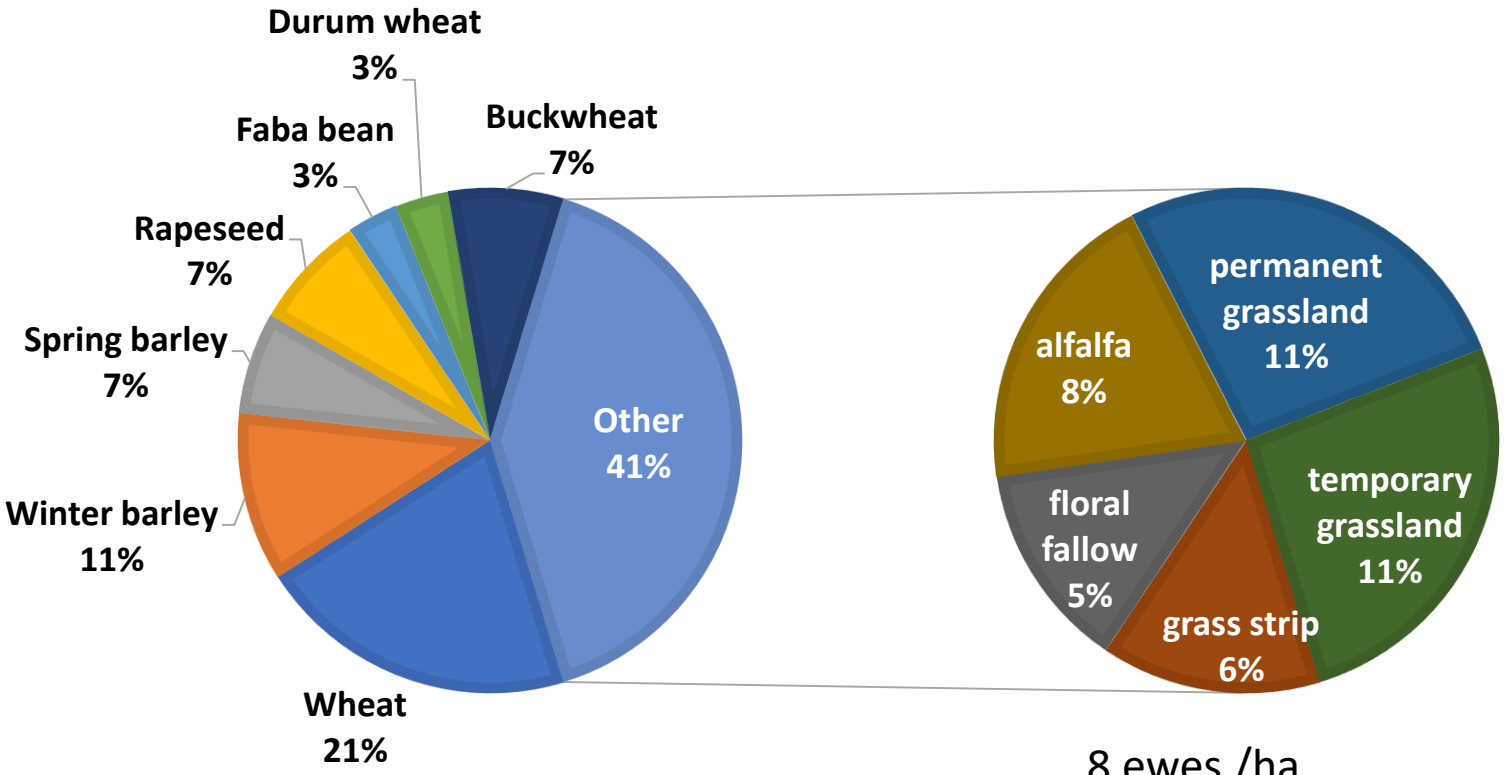
  Work: complementary with crops enterprise
- Fully free-range flock, with shelters in the plots
- Two breeds, 2 x 90 ewes: Romane and Berrichon de l'Indre (prolific).
- Individual monitoring of animals (weights, body cond. score, sales, etc.)
  - ➢ The 2 genotypes can be distinguished
- “System” approach, over 2 campaigns (2021-2022 = C1 and 2022-2023 = C2) (May 1 -> April 30)
- Benchmarking : Inosys réseaux d'Elevage n=16 farms (sheep-crops)

Using the Ostral simulation tool

- Precisely reconstruct the functioning of the flock for each campaign, calculating average annual numbers of ewes, LUs, etc.
- Enables "corrections" / adjustments to be made
  - “Straightening out" the numbers of animals at the end of C2 (ewes leaving early)
  - Reintegrating some of the lambs that died of arthritis in C1 → artificial suckling + 100kg concentrate"
  - Transforming the very small part of concentrate purchased into onfarm concentrate
  - Modeling the chain of equipment's, adapted to the size of the system
  - Simulate the results at system scale by separating the 2 genotypes

Crop rotation - Forages used

Agricultural Area Used = 61.1ha (around 40ha of Crops and 21 ha of grassland)



8 ewes /ha
(1.25 LU/ha)

\+

12,5 Catch crops (Autumn-Winter)

Fodder rape, common vetch, Brazilian oats, forage peas, Alexandria clover
(After harvest; usually direct seeding)

Zootechnical results

				ROM		BERR	
	C1	**C2**	INOSYS	C1	C2	C1	C2
Fertility (%)	73.4	77.1					
Prolificacy (%)	**223**	**212**		237	232	185	193
Lambs mortality (%)	15.4	21.1					
Ewe productivity (/ewe +6ths)	**1.50**	**1.39**	**1.25**	1.86	1.60	1.16	1.21
Weight productivity (kg carc/ewe)	**27.6**	**25.9**	**23.7**				
Lambs weight (kg carcass/head)	18.2	19.0	19.3				
Concentrate (Tot. kg/ewe)	**92**	**91**	**235**	112	105	73	78
used by ewes	33	42		33	44	32	41
used by lambs	59	48		79	62	41	37
Concentrate /kg carc. produced (kg)	**3.3**	**3.5**	**9.6**				

Economic results

				ROM		BERR	
	C1	C2	INOSYS	C1	C2	C1	C2
Gross product (€/ewe)	210	204		262	227	159	184
Operation. costs (€/ewe)	79	81		93	92	67	72
Gross margin (€/ewe)	**130**	**123**	**95**	169	135	92	112
Fodder autonomy (FU) (%)	**84.5**	**85.4**	60 ?				
Feed autonomy (FU) (%)	**98.1**	**98.8**					
Nitrogen balance (kg/ha)	**51.0**	**47.4**	39.0				
Fodder area Gross margin (€/ha)	**1076**	**1000**		1347	1069	794	929
Crops Gross margin (€/ha)	**363**	**351**					

Environmental results

				ROM		BERR	
	C1	**C2**	benchmark	C1	C2	C1	C2
Energy consumption (MJ/kg carcass)	**65.6**	**64.7**	92.1 (Idele, sheep-Cr)	60.1	63.8	76.0	67.2
those Fertilizers (%)	*23.7%*	*27.5%*					
Concentrate purch. (= milk) (%)	*17.0%*	*11.7%*					
Fuel (%)	*24.3%*	*24.3%*					
Equipments-Machines (%)	*20.2%*	*21.1%*					
Gross GHG emissions (kg CO2Eq/kg c)	**22.8**	**25.8**	31.6 (INRAE n=1180)	19.4	24.0	28.6	28.4
CO2 (% CO2Eq)	14.9	14.4	20.6 (INRAE n=1180)				
CH4 (% CO2Eq)	**61.6**	**61.2**	61.7				
N2O (% CO2Eq)	23.5	24.5	17.7				
Feed-Food competition	**0.42**	**0.35**	0.30 ?				

Discussion (1/2)

Points + + +

- A high ewe productivity

… while keeping concentrate use to a minimum

… thanks to lamb fattening on pasture in winter

… and despite off-season lambing

- Winter catch crop grazing ensures lamb fattening … and greatly limits parasite problems

→ very good economic and environmental results

NB : the Romane breed outperforms thanks to high proliferation + controlled mortality

Discussion (2/2)

Points - -

- One consequence of high prolificacy: the large quantity of powdered milk used (and consequences on all perf. indicators)
- Nitrogen supply penalizes environmental performance
- Almost all the ressources used for feeding are based on land cultivation → economic and environmental cost (machines)

Conclusion

A highly virtuous system with a number of advantages over other types of sheep farming systems in lowland areas

- either very grass-based, but with a high degree of seasonality
- … or integrated with arable farming but with high concentrate input

A sheep-crops farming system

- Productive
- Cost-efficient (concentrates)
- Meeting the requirements of the industry (in particular: seasonality)

Implementation may raise other issues, such as skills, work, organization, etc.

Thank you for your attention

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