Taking into account functional traits in dairy sheep breeding programs through the French example

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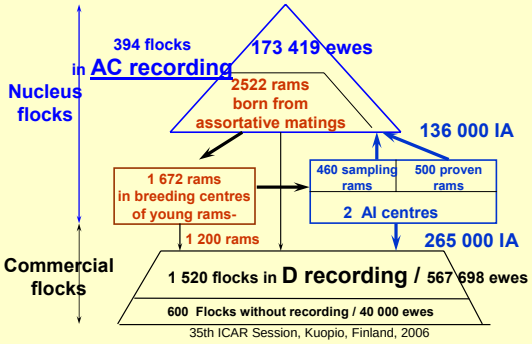
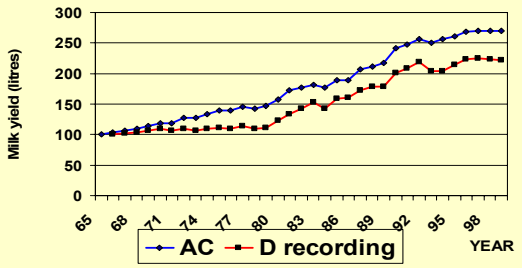
BREEDING SCHEME IN LACAUNE BREED (2002)



Phenotypic trend for milk yield in the Lacaune nucleus flocks (AC) and commercial flocks (D)



Simplification of Lacaune milk recording

- **Quantitative recording : monthly recording of one of the 2 daily milkings (AC design)**
- **Qualitative recording : part-lactation sampling in the middle of the lactation**

seasonality of the production

Description of the AC method

MONTHLY RECORDING OF MILK YIELD

AC Method
Milk yield

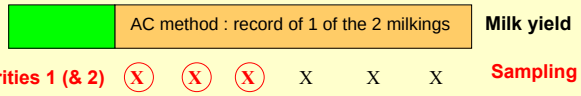
X X X X X X

morning test-day adjusted by bulk milk tank

(recording of one of the 2 daily milkings, example morning)

Simplification of Milk recording

Milk quality (optional disposition) : part-lactation sampling within AC method for milk yield

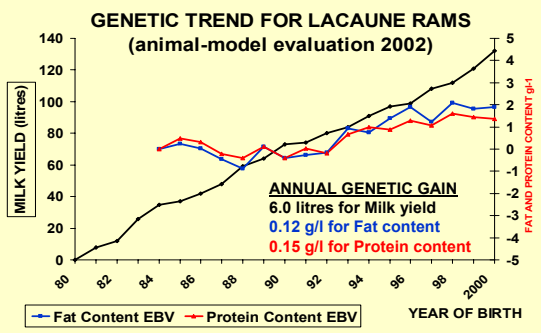


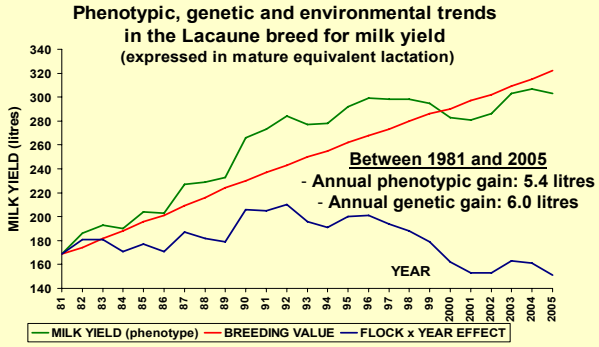
Parities 1 (& 2) (X) (X) (X) X X X **Sampling**

A4 method, all ewes ⟶ For 100 ewes : 100 x 12 = **1200 samplings**

Part-lactation sampling within AC method, parity 1 & 2 ⟶ For 100 ewes : 50 x 3 = **150 samplings**

(12,5 % / A4)



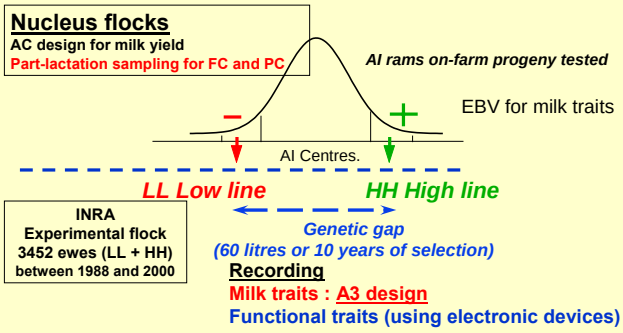


Selection on functional traits

- interest now to select for functional traits in the Lacaune breed
- the recording of relevant functional traits is a strong prerequisite

Which ones to include in the breeding goals ?

2 Milk yield Lacaune divergent lines



2 divergent lines: functional traits

Investigated functional traits to detect unfavourable indirect genetic responses

- feed efficiency: body weight, feed intake, body reserves
- reproduction traits:sexual precocity, out-of-season lambing ability, female fertility
- lamb production: suckling ability, prolificacy
- machine milking ability: milk flow kinetics (milking speed) and udder morphology (digital pictures, udder scoring)
- udder health: (mammary palpations, clinical mastitis, somatic cell count SCC)

Investigation conclusions

- no unfavourable genetic responses for most of the investigated functional traits
- selection on milk traits only (actual situation of all dairy sheep breeds) would lead in the long term to "baggy" udders more difficult to milk by machine and more susceptible to mastitis.

Simplification of SCC recording

- **Is the part-lactation sampling design conceived in 1985 for fat and protein contents (FC, PC) also relevant for SCC ?**

- **an experimental A4 recording carried out between 1994 and 1997 in a part of the Lacaune nucleus flocks to face this question.**

Simplification of SCC recording

Genetic parameters	Lactation mean LSCS (DIM >=25)	Partial lactation mean SCS for DIM		
		25-144 days	55-144 days	85-144 days
Heritability	0.15	0.12	0.12	0.14
genetic correlation with milk yield	0.11	0.12	0.16	0.17
Genetic correlation with lactation mean LSCS		0.99	0.98	0.96

Udder conformation: an appraisal method based on 3 scored udder traits

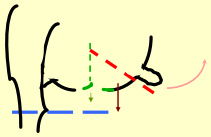
Digital pictures

Three scored udder type traits

TA: teat angle

UD : udder cleft

UD : udder depth



Recording of functional traits in the Lacaune nucleus flocks

- **SCC : since 1999 using the simplified part-lactation sampling design in first and second lactations**

- **Udder type traits: 3 scores traits (TA, UC, UD) in primiparous ewes since 2000.**

Genetic parameters (Lacaune breed)

	MY	FY	PY	FC	PC	LSCS	TA	UC	UD
MILK yield	0,32	+0,77	+0,88	-0,43	-0,48	+0,15	-0,05	0,00	-0,37
FAT yield	+0,83	0,26	+0,82	+0,24	-0,12	+0,21	-0,11	-0,08	-0,34
PROTEIN yield	+0,93	+0,85	0,28	-0,18	-0,01	+0,22	-0,07	-0,04	-0,39
FAT content	-0,20	+0,35	-0,06	0,41	+0,57	+0,07	-0,06	-0,10	+0,09
PROTEIN cont.	-0,35	-0,12	0,01	+0,40	0,51	+0,08	-0,01	-0,07	+0,07
LSCS	-0,14	-0,08	-0,06	+0,10	+0,24	0,15	-0,12	-0,21	-0,32
Teat angle	-0,03	-0,05	-0,03	-0,03	0,00	-0,04	0,35	+0,34	+0,31
Udder cleft	+0,07	+0,04	+0,06	-0,04	-0,04	-0,10	-0,20	0,32	+0,18
Udder depth	-0,26	-0,24	-0,27	+0,02	+0,02	-0,09	-0,14	+0,11	0,26

Heritabilities on diagonal

Genetic correlations above the diagonal

Environmental correlations under

Genetic parameters

121,283 first lactations between 2001 and 2004

Asymptotic genetic changes in 10 years according to the total merit index (TMI)

(Lacaune breeding programme based on progeny test of AI rams on 40 daughters)

TMI = 1 MP + α UH + β UT, with subindices MP, UH and UT in genetic standard deviation.

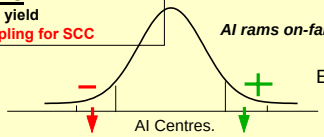
Genetic change in 10 years	Total merit index (TMI)			
	Economic values for MP, UH and UT [1, α, β]			
Trait	[1, 0, 0] MP1 (a)	[1, 0, 0] MP2 (b)	[1, 0.3, 0.3] MP2 (b)	[1, 0.5, 0.5] MP2 (b)
Milk production (MP)				
Milk yield (MY), l	61 (1.9 σ_g)	64	54	39 (1.2 σ_g)
Fat yield (FY), kg	4.2 (2.2 σ_g)	4.6	3.9	2.8 (1.5 σ_g)
Protein yield (PY), kg	3.4 (2.2 σ_g)	3.4	2.9	2.1 (1.4 σ_g)
Fat content (FC), g.l^{-1}	1.2 (0.3 σ_g)	1.5	1.3	1.0 (0.2 σ_g)
Protein cont. (PC), g.l^{-1}	1.3 (0.5 σ_g)	0.7	0.6	0.5 (0.2 σ_g)
Udder Health (UH)				
LSCS	0.38 (0.7 σ_g)	0.38	- 0.20	-0.54 (-1 σ_g)
Udder traits (UT)				
Teat angle (TA)	- 0.22 (-0.4 σ_g)	- 0.23	0.19	0.43 (0.7 σ_g)
Udder cleft (UC)	- 0.18 (-0.3 σ_g)	- 0.18	0.31	0.58 (0.9 σ_g)
Udder depth (UD)	- 0.32 (-1 σ_g)	- 0.33	-0.06	0.12 (0.4 σ_g)

(a) MP1 milk production subindex used until 2004

(b) MP2 new milk production subindex chosen in 2005

2 Lacaune divergent lines for SCC

Nucleus flocks
AC design for milk yield
Part-lactation sampling for SCC



High SCC line *Low SCC line*

Genetic gap
(3 standard genetic deviations)

INRA
Experimental flock
Started in 2003

Recording
Milk traits : A3 design + clinical mastitis
+ mammary palpations & bacterial analysis

Conclusions

- 2005: starting year for selecting Lacaune dairy sheep breed on functional traits: udder morphology and mastitis resistance (SCC) with the same weight than for milk production traits.
- as for FC and PC, SCC is recorded using the part-lactation simplified design, that means only 5 to 6 test days during all the productive life of each ewe.
- need to maintain a relevant accuracy for each individual test day as presently defined in ICAR requirements for recording devices (jars or meters) and for analytical quality analysis of sheep milk.

Thank you for your attention