Singular versus composite traits: what is the difference for maternal traits selection in meat sheep?

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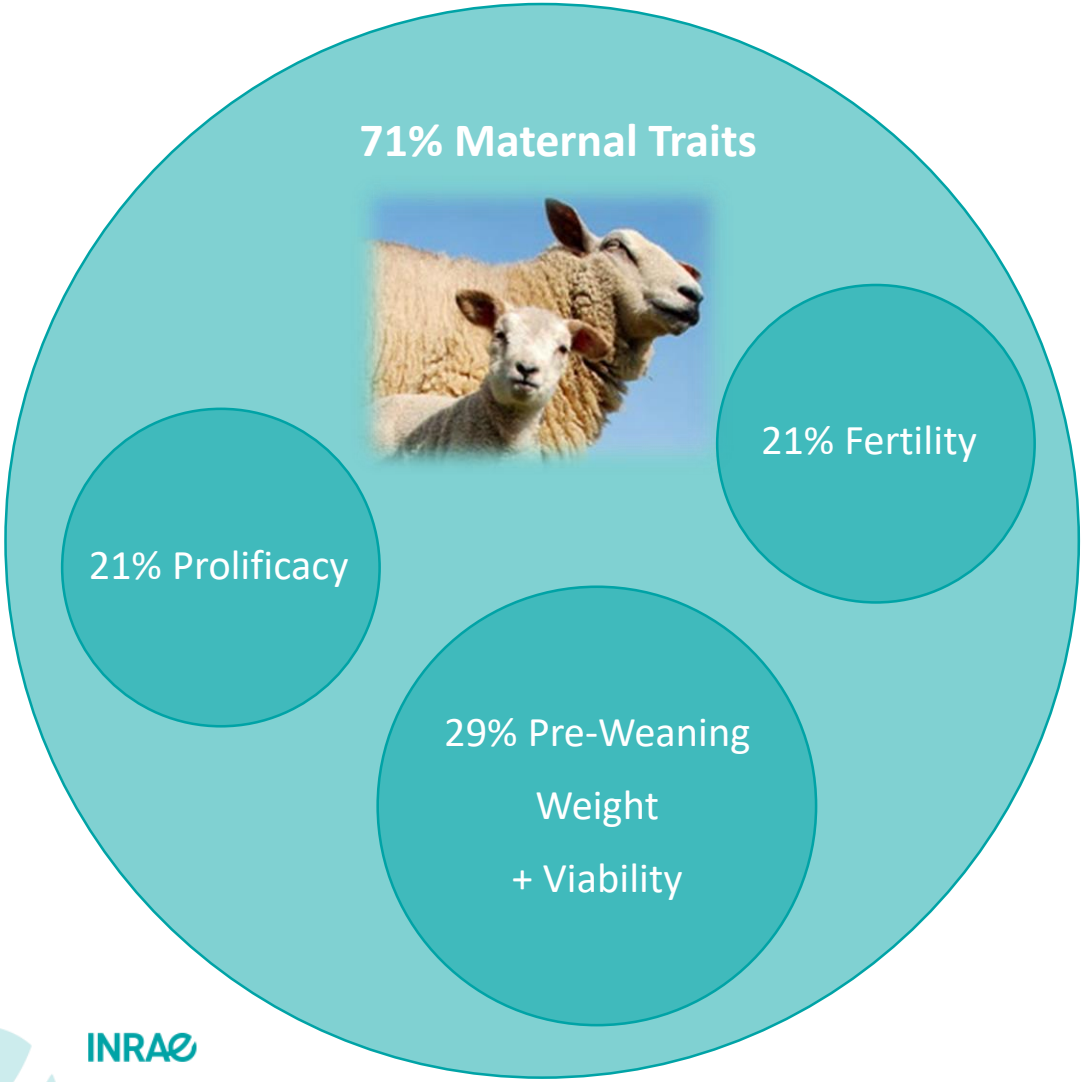
SELECTION OBJECTIVES



(Cheype et al., 2013)

Selection of Maternal Traits

First step: Estimation of EBVs

Litter Size EBV
Natural œstrus
Induced œstrus

Weight at 30 Days of Age EBV
Direct effect
Maternal effect

Viability EBV
Direct effect
Maternal effect

Second step: Linear combination of EBVs

Prolificacy Index

Pre-Weaning Weight Index

Viability Index

Maternal Abilities Index

Third step: Linear combination of indexes

ISAM
Maternal synthetic indice

Use for selection

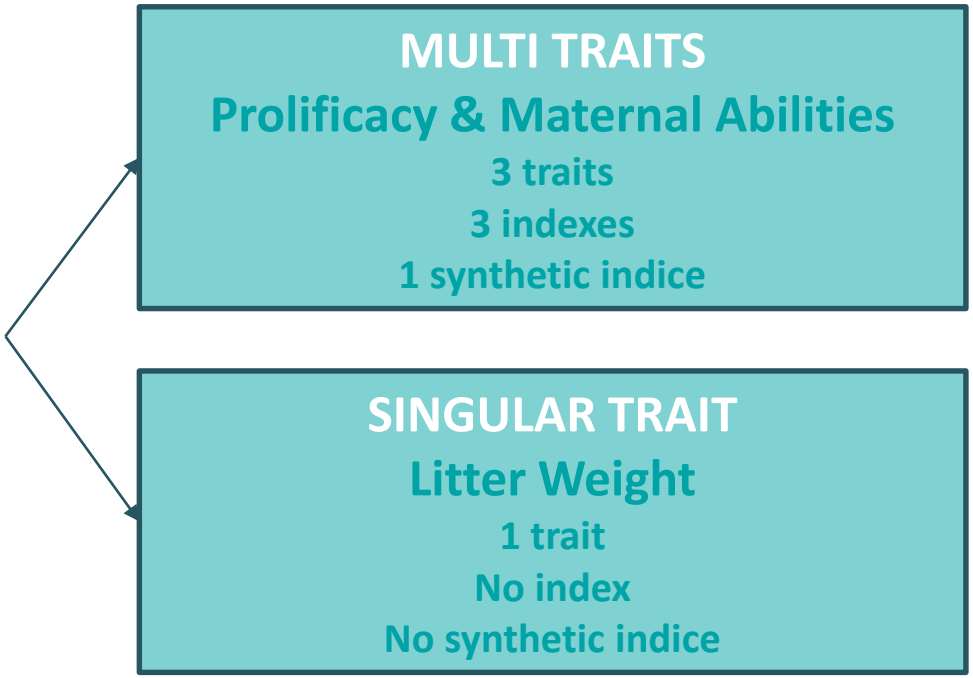
Tiphine et al., 2011

Context

- Breeders' economic objective = kg of lambs per ewe
- An alternative: selection on litter weight
  → LW = sum of lamb weights at 30 days of age
- LW: h^2 ranged from 0.02 to 0.11 (Bromley et al., 2001)

OBJECTIVE:

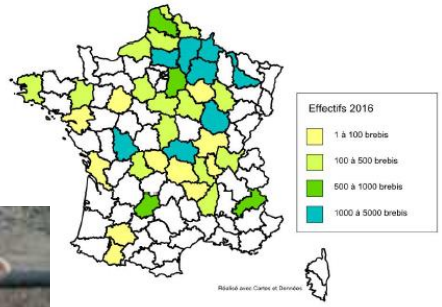
Maternal traits selection in meat sheep with



Material and methods: Dataset Description

Two French meat sheep breeds

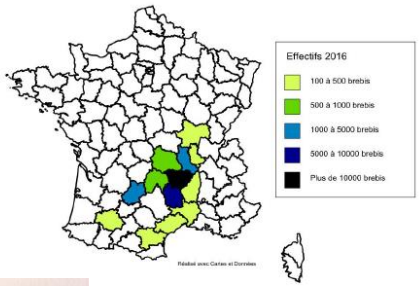
Ile de France
73,435 ewes
302,947 lambs



National Official Genetic Database

LS and W30D

From 2006 to 2018



Blanche du Massif Central
81,733 ewes
397,362 lambs

Data Analysis: BLUP Animal Models

1- Each trait of each breed was evaluated as in the official evaluation except Viability

2- Two multi-trait models considered

Similar to the models used in the official genetic evaluation

- Bi-trait model LS-LW

$$\begin{bmatrix} y_{LS} \\ y_{LW} \end{bmatrix} = \begin{bmatrix} X_{LS} & 0 \\ 0 & X_{LW} \end{bmatrix} \begin{bmatrix} b_{LS} \\ b_{LW} \end{bmatrix} + \begin{bmatrix} Z_{a\_LS} & 0 \\ 0 & Z_{a\_LW} \end{bmatrix} \begin{bmatrix} a_{LS} \\ a_{LW} \end{bmatrix} + \begin{bmatrix} Z_{p\_LS} & 0 \\ 0 & Z_{p\_LW} \end{bmatrix} \begin{bmatrix} p_{LS} \\ p_{LW} \end{bmatrix} + \begin{bmatrix} Z_{hys\_LS} & 0 \\ 0 & Z_{hys\_LW} \end{bmatrix} \begin{bmatrix} hys_{LS} \\ hys_{LW} \end{bmatrix} + \begin{bmatrix} e_{LS} \\ e_{LW} \end{bmatrix}$$

Type of oestrus considered as a fixed effect (rg >0.75)

- Bi-trait model LS-W30D with direct and maternal effects

$$\begin{bmatrix} y_{LS} \\ y_{W30D} \end{bmatrix} = \begin{bmatrix} X_{LS} & 0 \\ 0 & X_{W30D} \end{bmatrix} \begin{bmatrix} b_{LS} \\ b_{W30D} \end{bmatrix} + \begin{bmatrix} Z_{a\_LS} & 0 \\ 0 & Z_{a\_W30D} \end{bmatrix} \begin{bmatrix} a_{LS} \\ a_{W30D} \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & Z_{m\_W30D} \end{bmatrix} \begin{bmatrix} 0 \\ m_{W30D} \end{bmatrix} + \begin{bmatrix} Z_{p\_LS} & 0 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} p_{LS} \\ 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & Z_{mp\_W30D} \end{bmatrix} \begin{bmatrix} 0 \\ mp_{W30D} \end{bmatrix} + \begin{bmatrix} Z_{hys\_LS} & 0 \\ 0 & Z_{hys\_W30D} \end{bmatrix} \begin{bmatrix} hys_{LS} \\ hys_{W30D} \end{bmatrix} + \begin{bmatrix} e_{LS} \\ e_{W30D} \end{bmatrix}$$

3- Models with W30D and LW not converged

Results and Discussion: Genetic Parameters

		LS-W30D		LS-LW			
		Ile de France	Blanche du Massif Central	Ile de France	Blanche du Massif Central		
LS	r	0.08	0.08	0.08	0.08	r	LS
	h^2	0.04	0.05	0.05	0.06	h^2	

Results and Discussion: Genetic Parameters

		LS-W30D			LS-LW		
		Ile de France	Blanche du Massif Central		Ile de France	Blanche du Massif Central	
LS	r	0.08	0.08	r	0.08	0.08	LS
	h^2	0.04	0.05	h^2	0.05	0.06	
W30D	h^2_d	0.08	0.19				
	h^2_m	0.07	0.08				
	rg_{d_m}	-0.30	-0.45				
	$rg_{LS\text{-}dW30D}$	0.31	0.22				
	$rg_{LS\text{-}mW30D}$	-0.24	-0.51				

Results and Discussion: Genetic Parameters

		LS-W30D		LS-LW			
		Ile de France	Blanche du Massif Central	Ile de France	Blanche du Massif Central		
LS	r	0.08	0.08	0.08	0.08	r	LS
	h^2	0.04	0.05	0.05	0.06	h^2	
W30D	h^2_d	0.08	0.19	0.10	0.07	r	LW
	h^2_m	0.07	0.08	0.06	0.04	h^2	
	rg_{d_m}	-0.30	-0.45	0.78	0.67	rg_{LS-LW}	
	$rg_{LS-dW30D}$	0.31	0.22				
	$rg_{LS-mW30D}$	-0.24	-0.51				

Results and Discussion: Genetic Progress Curves

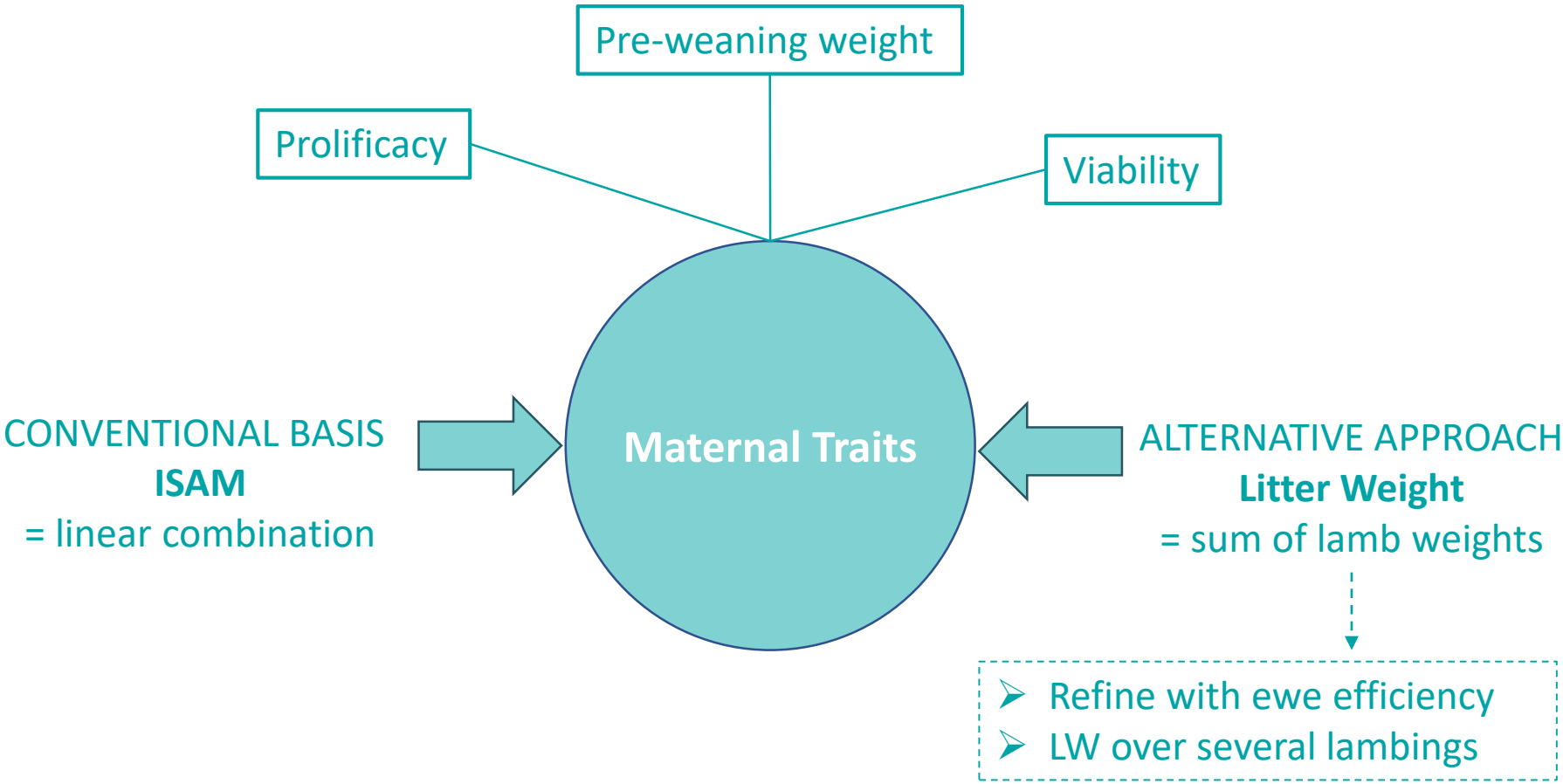
Ile de France

$r_{ISAM-LW} = 0.85$

Blanche du Massif Central

$r_{ISAM-LW} = 0.85$

Conclusion



Thank you for listening