



➤ Estimation of genetic parameters for fertility and prolificacy in the Lacaune meat sheep population carrying a hyperprolific gene

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> Context

PRODUCTIVITY

= Main objective to maintain production potential and economic security in the French sheep industry

PROLIFICACY

= Number of lambs born/number of lambings

Easy to measure



Well known genetic parameters

Induced Œstrus (+ artificial insemination) $\rightarrow h^2 = 0.08$

Natural Œstrus (+ natural mating) $\rightarrow h^2 = 0.10$



INRAE

Emilie Cobo

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FERTILITY

= Number of ewes lambing/number of ewes joined

Complex trait



Large number
of variation factors

Practices in natural mating
rarely recorded

➤ Objective

Meat sheep Lacaune population of Ovi-Test breeding program



Presence of major gene for ovulation: *FecL*

PROLIFICACY



Known impacts:

Average increase

Appearance of exceptional litter sizes

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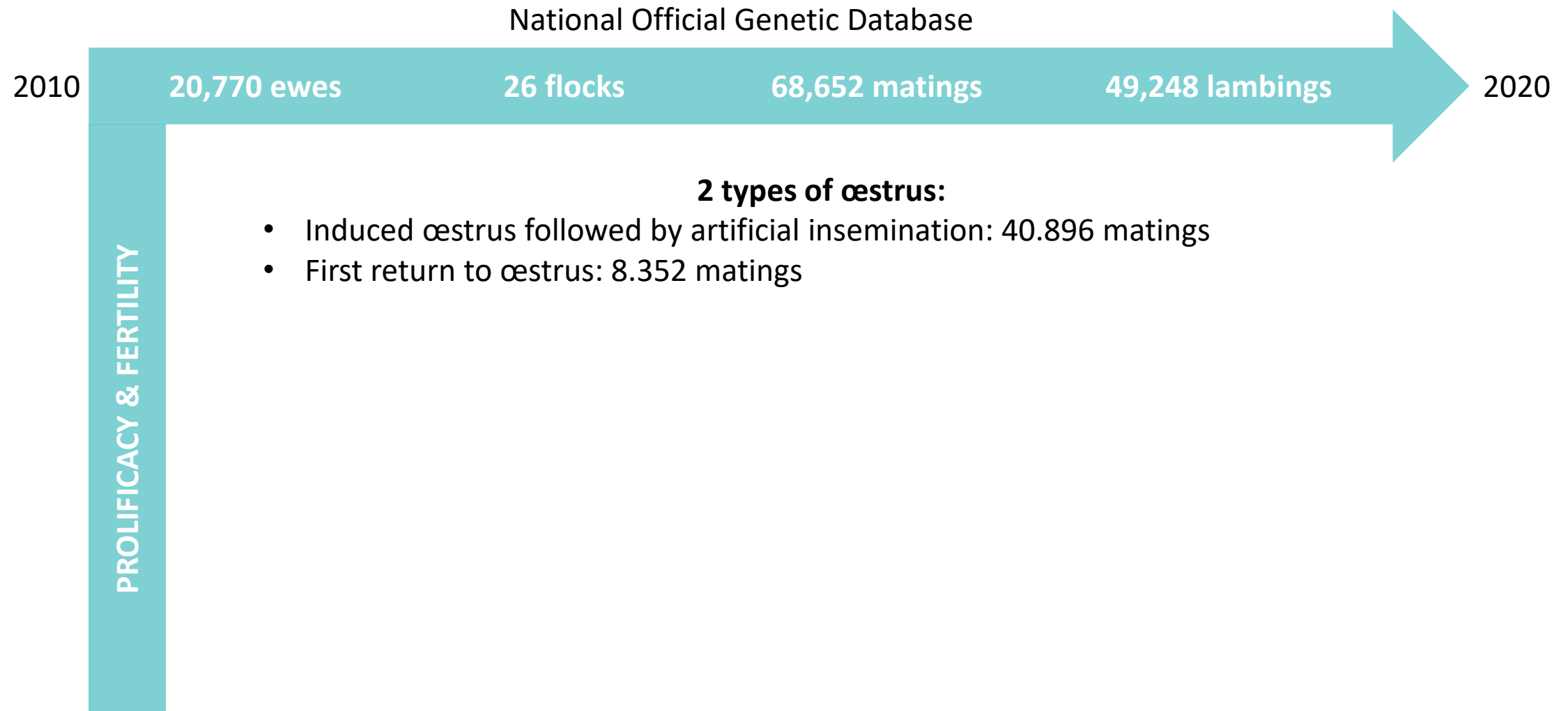


Contributing knowledge

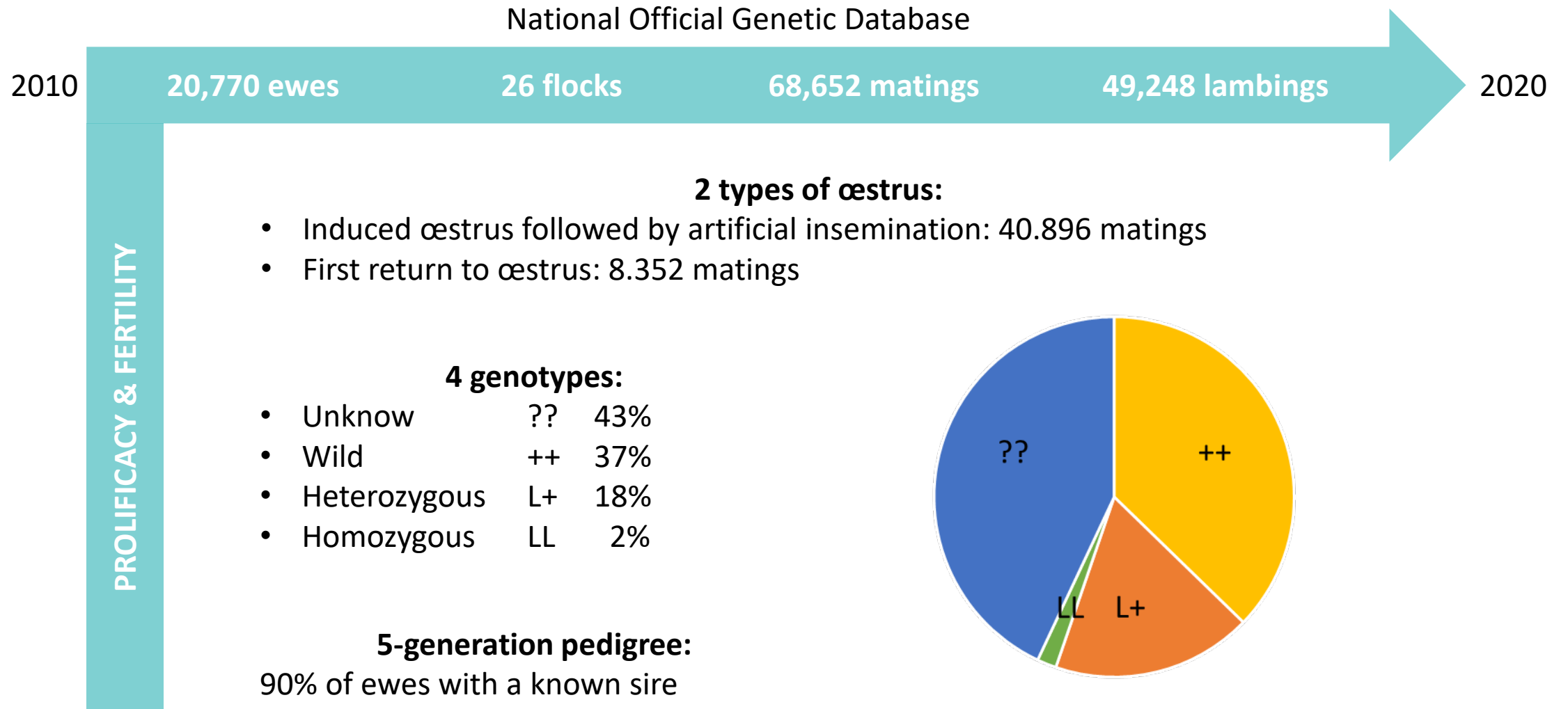
Positive effect ?

Estimation of
genetic parameters

➤ Material and methods



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BLUP Animal Model
(ASReml)

PROLIFICACY

1 Bi-traits model:
PROLIFICACY on Induced Œstrus ;
PROLIFICACY on First Return to Œstrus

Genetic correlation

FERTILITY

2 Single-trait models:
FERTILITY on Induced Œstrus and
FERTILITY on First Return to Œstrus

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2 Single-trait models:
FERTILITY on Induced Œstrus and
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6 fixed effects:

- Genotype (4 levels)
- Previous litter size (3 levels)
- Previous lambing number (4 levels)
- Post-partum interval (4 levels)
- Month of mating (3 levels)
- Age of female at mating (3 levels)

1 animal effect

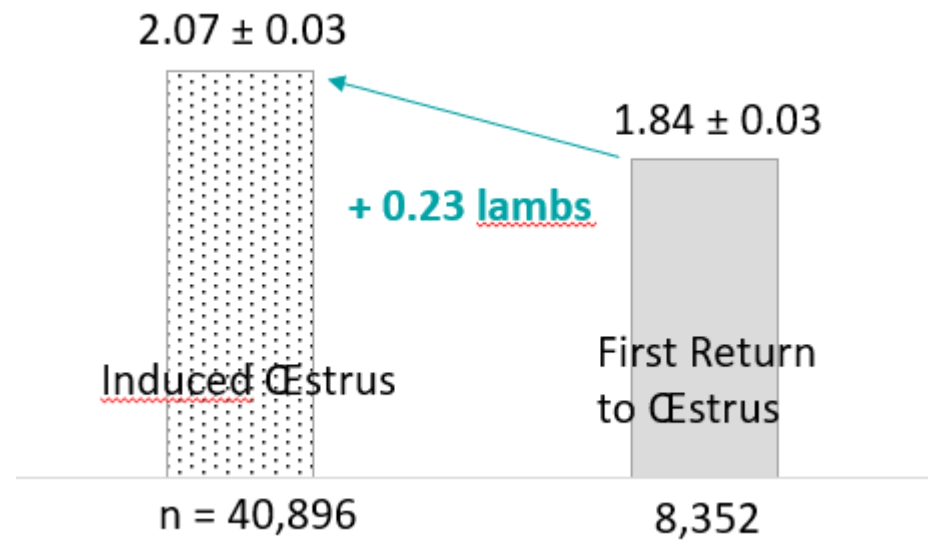
3 random effects:

- Animal permanent environment
- Herd-year-season
- Residual

➤ Results and Discussion

LSMeans and S.E. of prolificacy (1 bi-traits model)

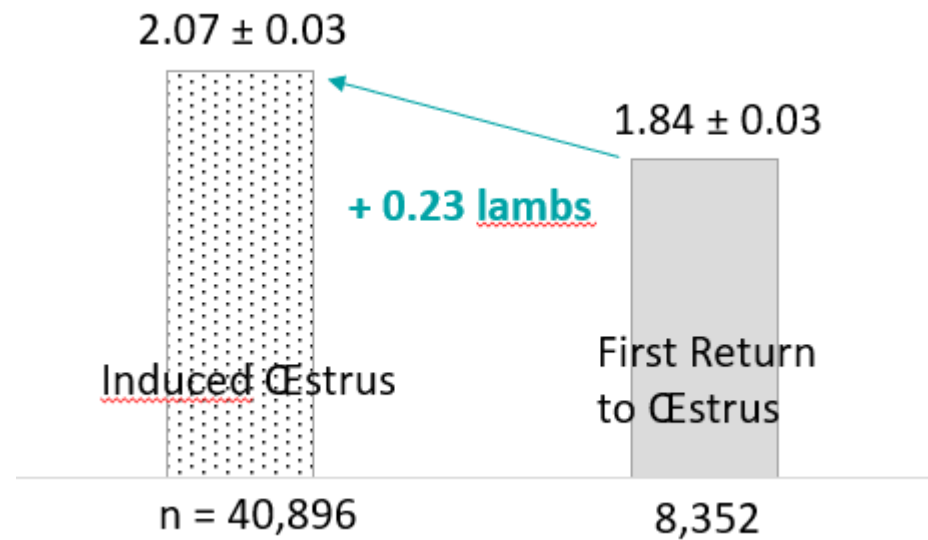
Per type of œstrus



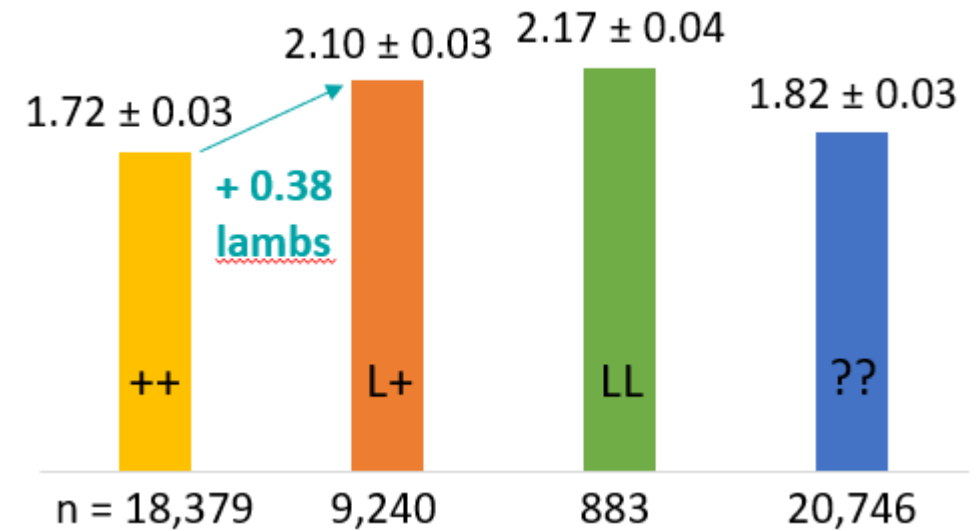
➤ Results and Discussion

LSMeans and S.E. of prolificacy (1 bi-traits model)

Per type of œstrus



Per genotype (P < 0.0001)



➤ Results and Discussion

Genetic parameters of prolificacies on induced œstrus and first return to œstrus

Bi-traits model	Induced Œstrus	First Return to Œstrus
Additive Genetic Variance σ^2_a	0.046 (0.005)	0.043 (0.008)
Animal Permanent Environment Variance σ^2_{pe}	0.020 (0.005)	0.040 (0.012)
Residual Variance σ^2_e	0.643 (0.006)	0.419 (0.012)

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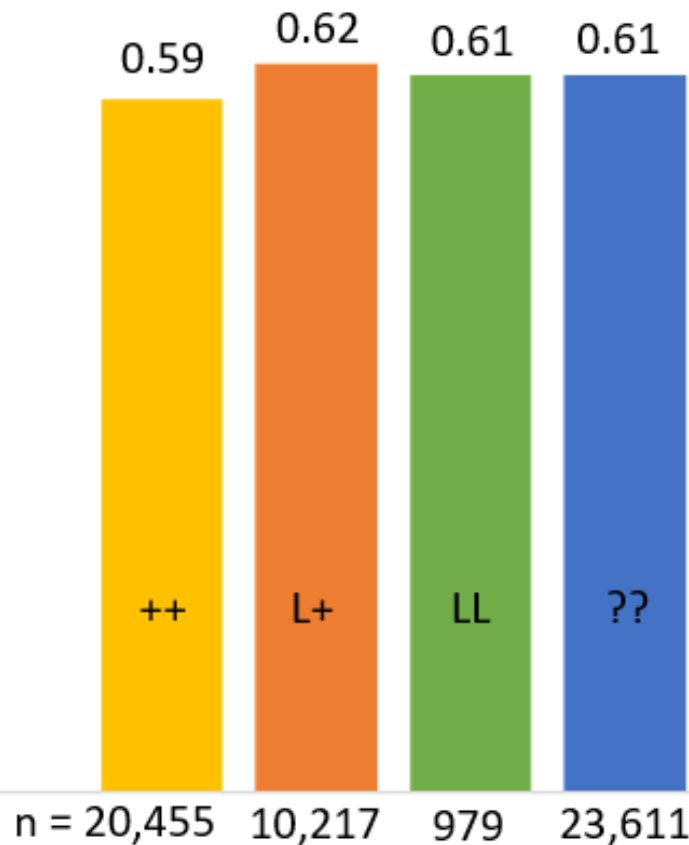
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Residual Variance σ^2_e	0.643 (0.006)	0.419 (0.012)
Repeatability r	0.09 (0.01)	0.16 (0.02)
Heritability h^2	0.06 (0.01)	0.09 (0.01)
Genetic Correlation r_g	0.95 (0.05)	

➤ Results and Discussion

LSMeans of fertility per genotype for each type of œstrus (2 independant models)

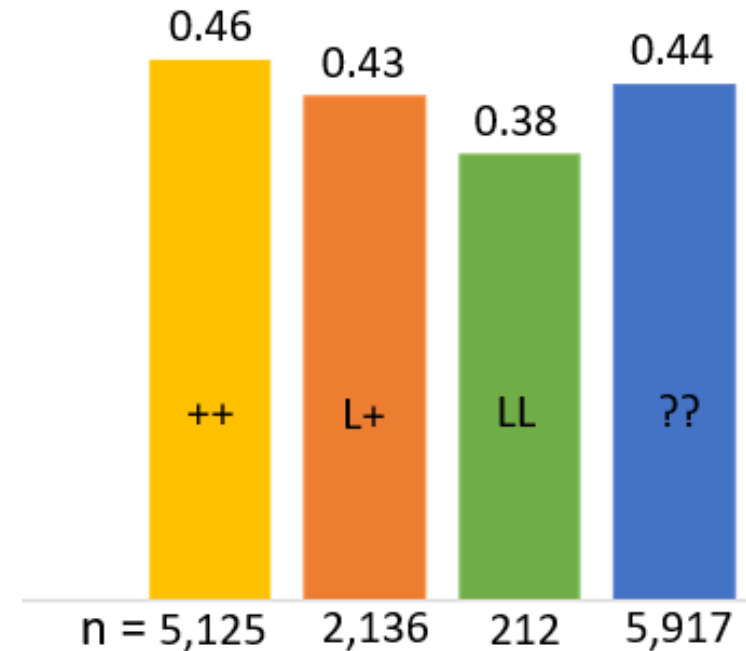
Induced œstrus

$P_{\text{Genotype}} < 0.001$



First return to œstrus

$P_{\text{Genotype}} = 0.005$



➤ Results and Discussion

Genetic parameters of fertility on induced œstrus and first return to œstrus

One trait model	Induced Œstrus	First Return to Œstrus
Additive Genetic Variance σ^2_a	0.007 (0.001)	0.007 (0.002)
Animal Permanent Environment Variance σ^2_{pe}	0.012 (0.001)	0.009 (0.003)
Residual Variance σ^2_e	0.161 (0.001)	0.188 (0.004)

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Animal Permanent Environment Variance σ^2_{pe}	0.012 (0.001)	0.009 (0.003)
Residual Variance σ^2_e	0.161 (0.001)	0.188 (0.004)
Repeatability r	0.10 (0.01)	0.08 (0.01)
Heritability h^2	0.04 (0.01)	0.03 (0.01)

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- Non-zero but low heritabilities whatever the type of œstrus
→ trait difficult to improve through genetic selection
- Positive effect of the gene on fertility not confirmed by the study



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- Expected effect of the gene *FecL* on prolificacy
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➤ **FIRST RETURN TO OESTRUS:**

- Collect more and better variation factors
- Bias of the first return to oestrus study: ewes present at the first return to oestrus are necessarily ewes that failed in the previous oestrus



Thank you for listening