INRAE

> ## Divergent genetic selections for social attractiveness or tolerance toward humans in sheep

Dominique HAZARD

GenPhySE (Genetics, Physiology and Breeding Systems)

INRAE Toulouse (France)

dominique.hazard@inrae.fr

CONTEXT

Global overview

1) Evolution of sheep farming systems includes (FR) :
- increased size of flock
- reduced support provided by human
- use of wide diversity of farming systems :
    from intensive to extensive : including use of harsh environments

2) Increase of the demand from
- Breeders: - more efficient and resilient sheep
            - sheep easy to breed (→ to facilitate labour)
- Society: ↑ welfare, ↑ agroecology

Need to produce animals with higher adaptive capacities

➤ Issue = to improve adaptation by developing animals' behavioural autonomy (improve welfare, maintain production…)

INRAC

Genetic selection for behaviours in sheep
05-07-2022 / WCGALP / Hazard D.

p. 2

❯ CONTEXT

SHEEP = Gregarious and social species

⌄⌄

➢ Social behaviours = a way for sheep to adapt themselves to environment through social group

• Relationships between:
- conspecifics
- dam and lambs
- animal and human

> Social cohesion, facilitation
> Offspring survival
> Labour of shepherd
> Welfare…

Genetic selection for behaviours

⌄⌄

➢ One of the levers to improve adaptation and welfare

• Genetic variability reported for several behaviours in sheep:

- Maternal behaviours, sociability towards conspecifics, docility towards humans (h^2 =0.10 to 0.5)

Hypothesis: Higher sociability (social attractiveness) and/or docility (tolerance) towards humans may improve adaptation of sheep

➥ And consequently, may improve welfare, labour of shepherd, production

Objective: **To investigate i) feasibility and efficiency of a genetic selection for sociability or docility towards humans**
ii) impacts of such selection on several traits

INRAⓔ

Genetic selection for behaviours in sheep
05-07-2022 / WCGALP / Hazard D.

p. 3

Material and Methods

Animals:

➢ Romane breed (meat sheep)

➢ flock raised outdoors all along the year (280 ewes)

       fed on rangelands (1 ewe/ha)

       at the experimental farm La Fage (Roquefort sur Soulzon)

➢ Lambing takes place outdoor (April)

➢ Lambs were phenotyped for behaviours
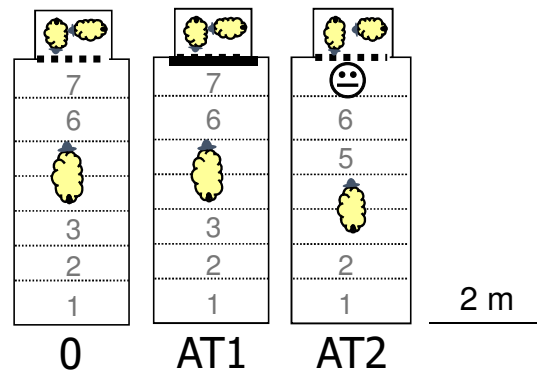
       - 10 days after weaning (~90 days of age)

Causse du Larzac

INRAE

Genetic selection for behaviours in sheep
05-07-2022 / WCGALP / Hazard D.

p. 4

Material and Methods

Two behavioural tests : - **reactivity to social isolation in absence or presence of a human**

- **reactivity to an approaching human**

Arena test

Unfamiliar enclosure (dirt floor, 2m high solid wooden walls, 7 zones)

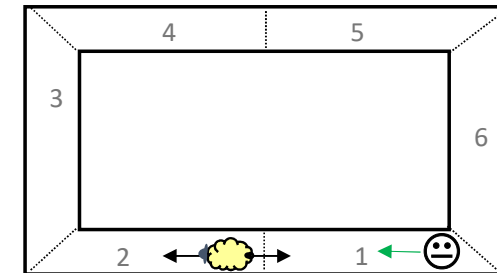**0:** conspecifics behind a grid-barrier, lamb introduced

AT1: opaque panel pulled down to separate conspecifics and tested lamb.

AT2: panel pulled up and a human enters and stays in front of the grid

Corridor test

Test pen = a closed, wide rectangular circuit

CT1: animal alone in the pen

CT2: animal with an approaching human (walking at a regular speed to achieve two tours in 1 min)
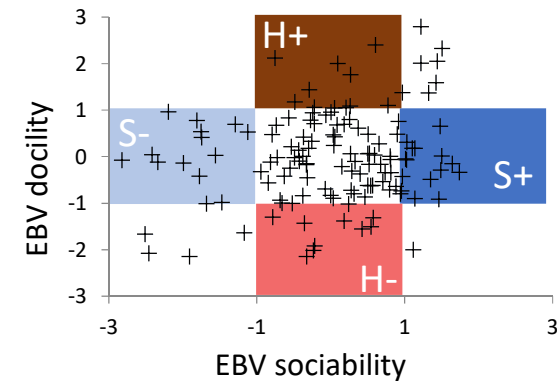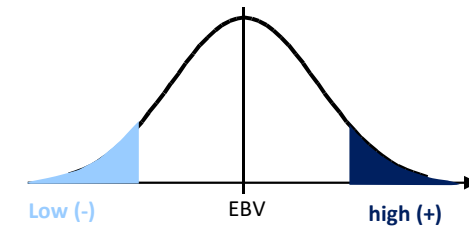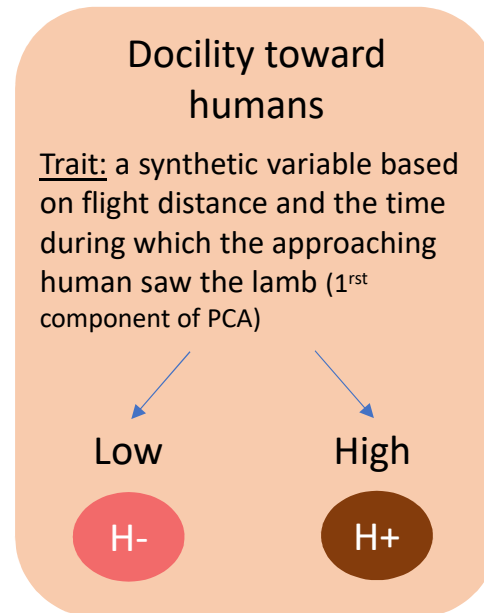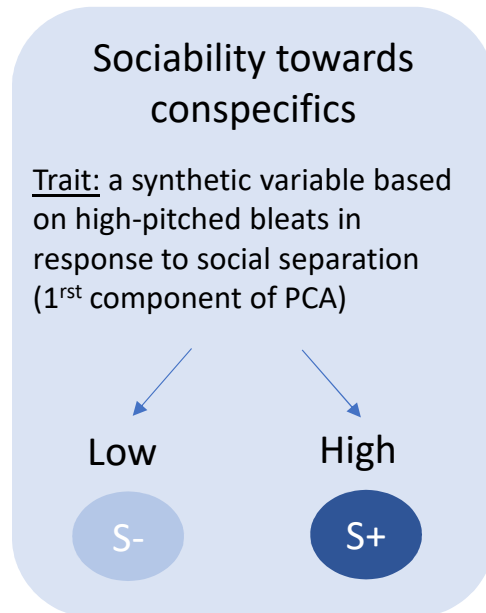
Behaviours recorded during 1min (each phase):

- High-pitched bleats (number)

- Locomotion (number of zones entered), vigilance posture

- Proximity score with conspecifics and a human
  (score computed depending upon time spent in different zones)

- Flight distance from human

INRAE

Genetic selection for behaviours in sheep
05-07-2022 / WCGALP / Hazard D.

p. 5

Four divergent lines constituted :

Individual EBVs were computed for sociability and docility

Low (-)   EBV   high (+)

Sociability towards conspecifics

Trait: a synthetic variable based on high-pitched bleats in response to social separation (1rst component of PCA)

Low   High

S-   S+

Docility toward humans

Trait: a synthetic variable based on flight distance and the time during which the approaching human saw the lamb (1rst component of PCA)

Low   High

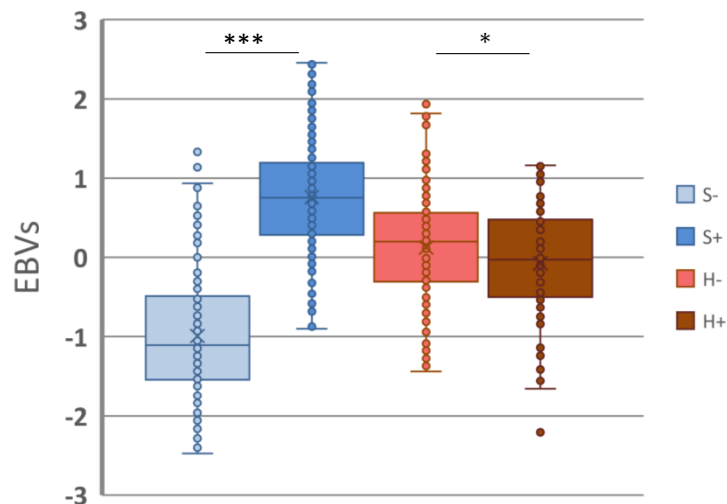H-   H+

EBV docility

H+

S-   S+

H-

EBV sociability

➢ Two generations:
- ~300 female and male lambs /generation/line
- In average 10 sires and 70 dams /generation/line (selection intensities 10 and 45 % respectively)
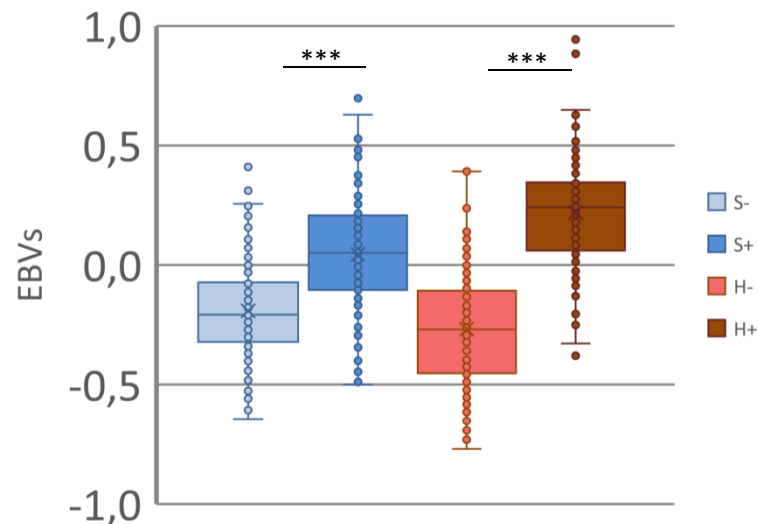
Sociability towards conspecifics

> **S-/S+ : 1.8 σ_g**
> **H-/H+ : intermediary for sociability compared to sociability lines**

Docility towards humans

> **△ H-/H+ : 1.0 σ_g**
> **S-/S+ : high difference for docility**

☞ Hypotheses :

1- could be linked to the low positive genetic correlation between sociability and docility (r_g=0.25 ± 0.11)

2- may be due to the selection criterion that involved measurement of reactivity to social separation in presence of a human

INRA℮

Genetic selection for behaviours in sheep
05-07-2022 / WCGALP / Hazard D.

p. 7

Behaviours (lsmeans)		Test	S-	S+	Line	H-	H+	Line
Vocalizations	number	AT1	8.0	16.2	***	13.6	11.9	***
Vocalisations	number	AT2	3.0	7.6	***	5.7	5.0	NS
Locomotion	number	AT1	23.3	27.2	***	26.5	24.0	*
Locomotion	number	AT2	6.6	7.2	NS	7.2	4.9	**
Vigilance	sec	AT1	18.6	18.2	NS	17.7	19.3	NS
Proximity Score	sec	AT2	23.9	27.9	*	25.0	29.1	*
Flight distance	meter	CT2	5.5	5.3	*	5.6	5.1	***

Line effect, pval * < 0.05; ** < 0.01; *** <0.001

Expected responses

➢ High line for sociability (S+): exhibited higher level of vocalization, locomotion, and proximity

☞ Hypothesis: S+ lambs exhibited higher behavioural activity in order to maintain the social link

➢ Selection for social attractiveness affected locomotor activity in a context specific way (AT1 vs AT2)

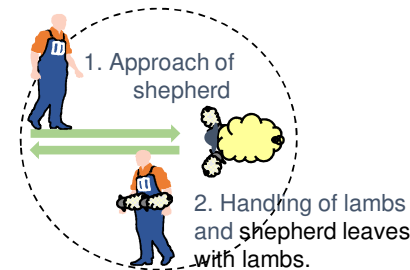➢ High line for docility (H+): exhibited higher tolerance toward human, lower level of vocalization and locomotion

☞ Hypothesis: H+ lambs may be less reactive to the social separation in the arena test.
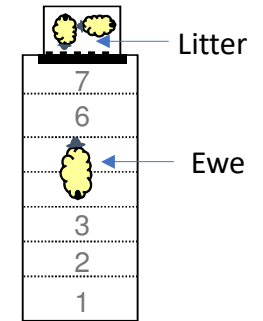
❯ Results

Females of the divergent lines phenotyped for maternal reactivity at lambing:
- Maternal behaviour score (MBS)
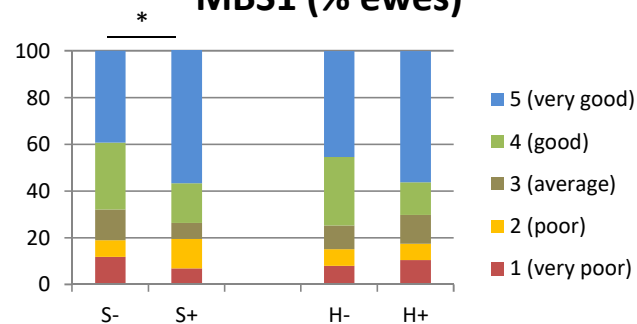- Social Behaviours in arena test

Behavioural test
(on the lambing spot)

1. Approach of shepherd
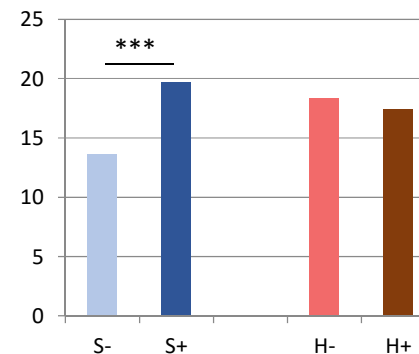
2. Handling of lambs and shepherd leaves with lambs.

Arena test
(24h post lambing)

Litter

Ewe

7 6 3 2 1

MBS1 (% ewes)

Legend:
- 5 (very good)
- 4 (good)
- 3 (average)
- 2 (poor)
- 1 (very poor)

➤ High lines for sociability (S+) showed higher % of ewes having a very good behaviour

Vocalization (lsmeans)

Locomotion (lsmeans)

➤ High line for sociability (S+) : exhibited higher level of social behaviours
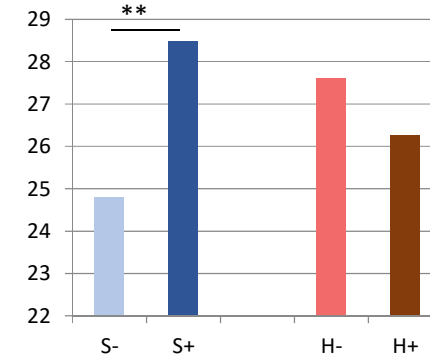
➔ Selection at weaning for higher :

Sociability ⟶ increased maternal attachment

Docility ⟶ *tendencies to confirm*

INRAE

Genetic selection for behaviours in sheep
05-07-2022 / WCGALP / Hazard D.

p. 9

Conclusion

- **Heritable traits:**
  - sociability toward conspecifics
  - docility toward humans

> **Experimental selection for sociability or docility:**
  - works
  - impacts some additional behavioural traits in arena test
  - impacts maternal reactivity at lambing

- **Further works in progress :**
  - to investigate welfare status in the divergent lines
  - to investigate impact of such selection on production (lamb survival, growth)
  - to investigate impact of such selection on social behaviour in the group

INRAe

Genetic selection for behaviours in sheep
05-07-2022 / WCGALP / Hazard D.

p. 10

❯ ACKNOWLEDGEMENTS

• Collaborators

Smarter
SMAll RuminanTs breeding for Efficiency and Resilience

In memory of Carole
MORENO-ROMIEUX

Carole **MORENO-ROMIEUX**

INRA*e*

Genetic selection for behaviours in sheep
05-07-2022 / WCGALP / Hazard D.

p. 11

Thank you for
your attention