Actual and expected benefits from recent and on-going projects on the genetics of adaptation and resilience in the French dairy sheep and goats

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EAAP Annual (Virtual) Meeting 2020

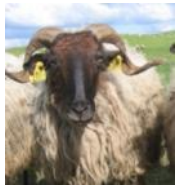
Session 47: Combining the diversity of resources and farming practices to ensure resilience at different scales

3 Dec 2020

Dairy sheep and goats breeding programs in France






	Alpine	Saanen	Lacaune	Corse	Basco-Béarnaise	Black-Faced Manech	Blond-Faced Manech
Population	450 k	350 k	1000 k	85 k	90 k	80 k	270 k
% in breeding program	27%	20%	22%	21%	30%	12%	28%
# new males in AI / year	50	40	445	25	44	26	146
% AI in breeding program	34%	34%	85%	36%	50%	45%	50%
Annual Genetic gain (σ_g)	0.17	0.17	0.23	0.10	0.16	0.11	0.17

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Genomic selection in French dairy sheep and goats

2015:	2017:	2018:	2020:
Lacaune	Pyrenean sheep breeds	Alpine & Saanen	Corse

- Total or partial suppression of progeny-test
- Young males used as proven males thanks to GEBVs
- Large range of reliabilities of GEBVs according to reference population [0.40 – 0.80]
- Early and strong genomic selection pressure
- Decrease in generation interval of males

Impact of genomic selection in Lacaune: +30% genetic progress on total merit index

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Breeding goals

The breeding goals depends on the breed

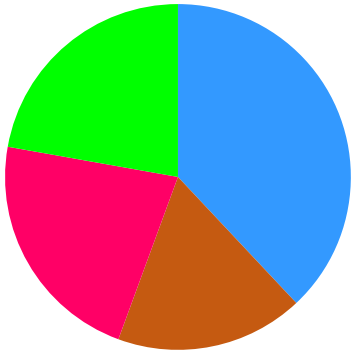
However, the traits included in the criteria are so far:

- PRODUCTION traits: **MY**, **αFY+βPY**, **αFC+βPC**
- FUNCTIONAL traits: **UDDER**, **CELL**

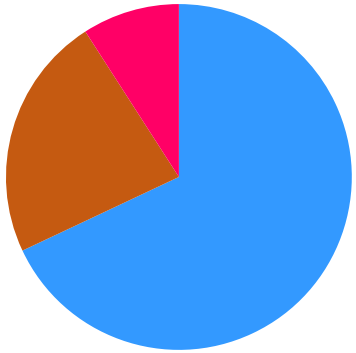
Lacaune

Basco-Béarnaise

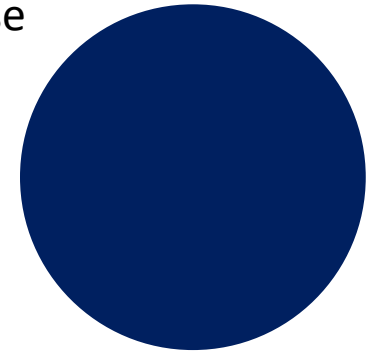
Red-Faced Manech



Black-Faced Manech

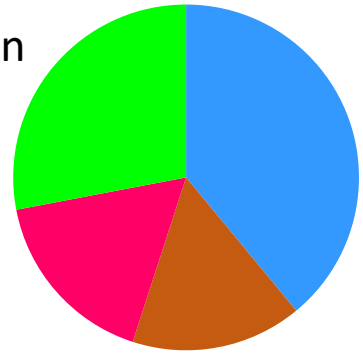


Corse



Alpine

Saanen



A strong effort of R&D to meet the needs of getting more balanced breeding goals

Why this demand for better adaptation and more resilience?

- Anticipate climatic change
- Increase health challenge
- Seek animals able to manage the trade-offs
- Agro-ecological systems requires more rusticity

RUSTIC

iSAGE Innovation for Sustainable Sheep and Goat Production in Europe

Paralut

ardi Research, Development and Innovation in sheep

Smarter

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Adaptation to climatic change

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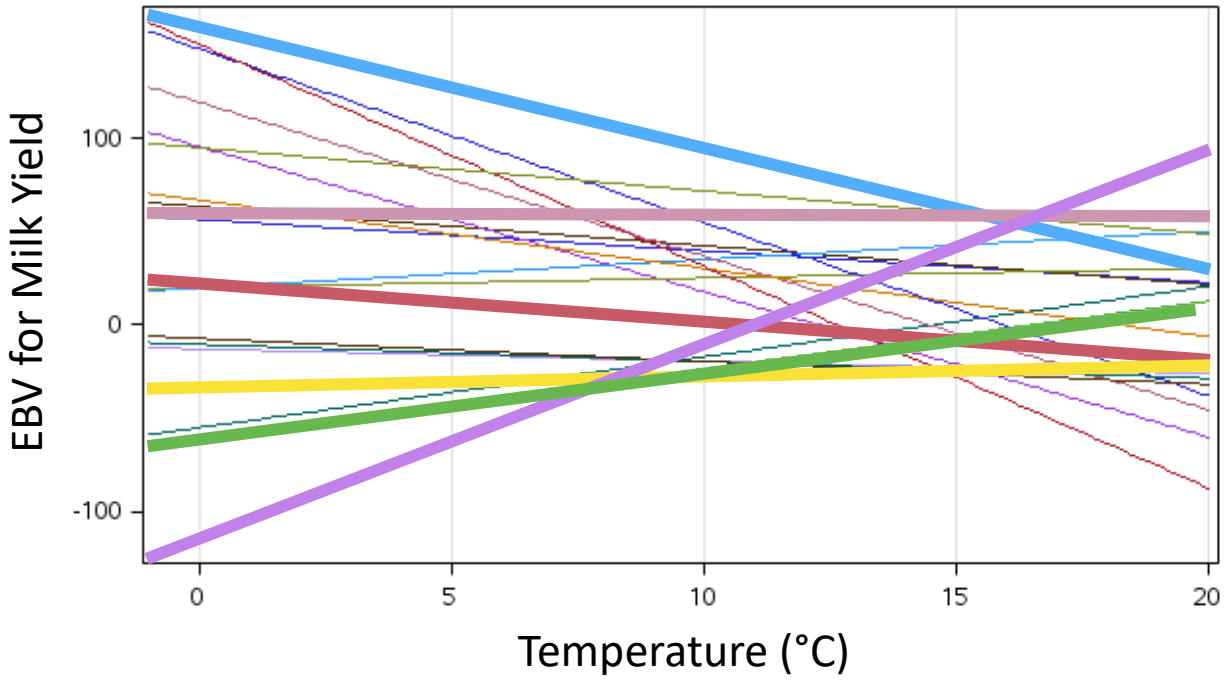
A variability of animal response across a range of temperature (dairy sheep/goat)



The genetic merit of an animal is not the same according to the temperature

It is possible to select animal better adapted to higher temperature.

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Genotype x Environment Interactions

Are selected males adapted to every breeding systems/environments
Is a unique breeding goal relevant?

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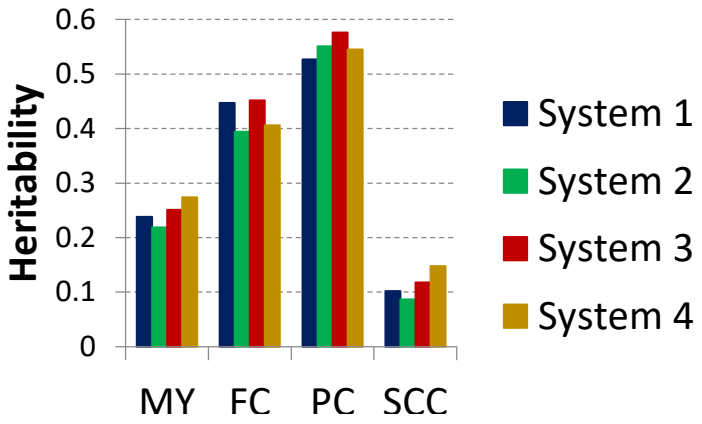
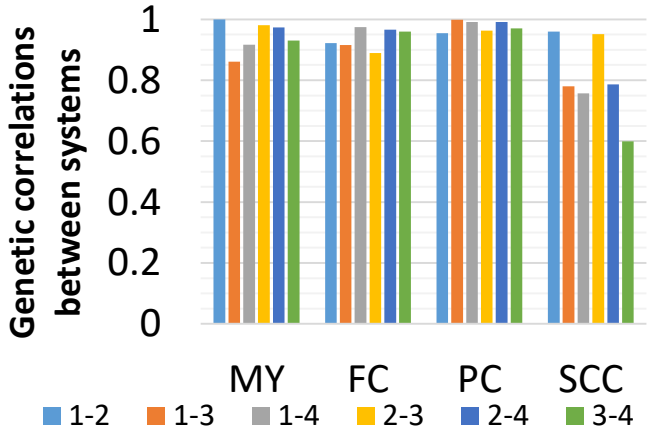
Ex. Lacaune dairy sheep breed (Source: Buisson et al. EAAP 2020)



Small scale effect



Few re-ranking across system (dairy traits)

MY : milk yield
FC & PC : fat & protein contents
SCC : somatic cell score

=> Selection is adapted to the range of environment where the breed is raised

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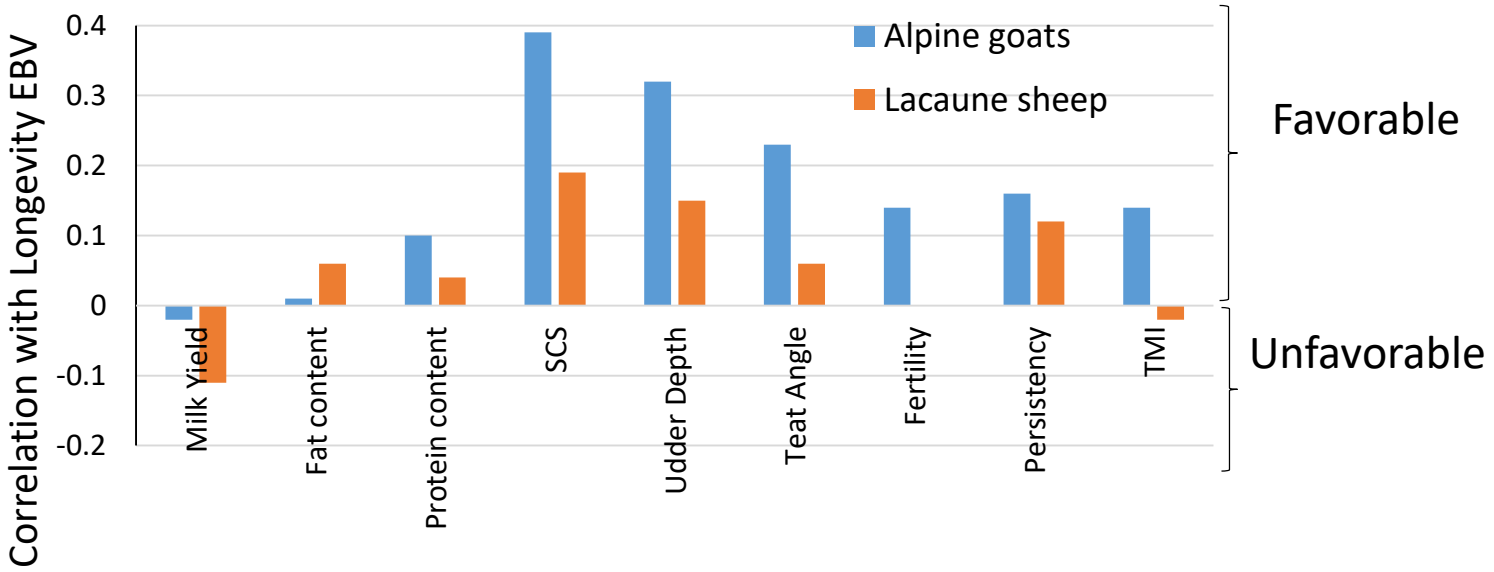
Functional longevity

Correlation between Longevity EBVs and other traits EBVs



Functional longevity positively correlated with udder health / morphology, fertility and milk persistency.

Functional longevity slightly negatively correlated with milk yield

Longevity should cope with various culling causes that cannot be easily recorded

SMARTER and resilience-related traits

Smarter

Improve efficiency …

Higher feed efficiency
Optimize dynamics of body tissue mobilization
Mitigate GHG

… while improving resilience

Diminish disease
Improve reproduction, longevity and lamb survival

Manage trade-off

Experimental INRAe farms
+
private farms
(15 dairy sheep / 15 dairy goat)
+
Underutilized breeds

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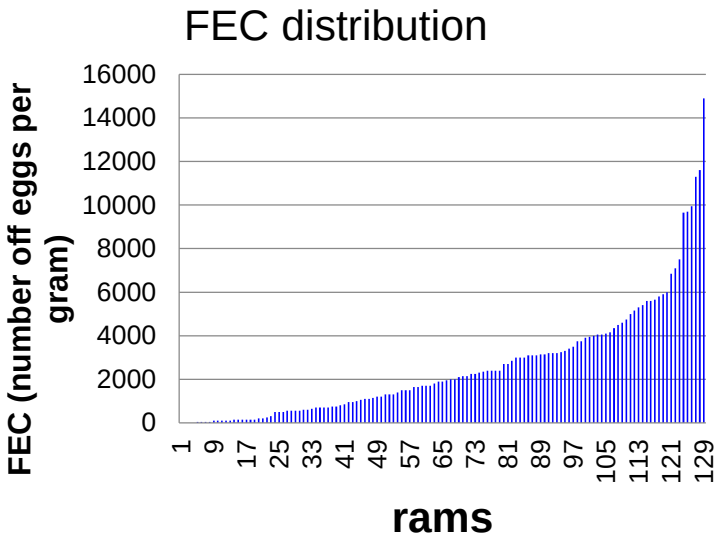
-Reproduction (incl. ultrasonic pregnancy scan)
-Longevity, (perinatal) mortality, culling causes
-Resistance to parasites
-Individual scoring for visual health parameters
-MIR spectra for assessing health through digestive and metabolic status.
-Metabolites

Resistance to parasites

- Gastro intestinal nematodes (GIN) favored by climatic change, especially in Atlantic areas
- GIN resistance to anthelmintics is increasing
- Negative impact of anthelmintic molecules on the entomofauna of the soil.

- Design of experimental infection oriented toward collective rams has been developed.
- Used for a decade in Pyrenean dairy sheep breeds.
- Fecal Egg Count as proxy for **resistance** to GIN. h2 0.15-0.30 / high variability
- Loss of Packed Cell Volume after infection as a proxy of **resilience** of rams. h2 0.20-0.25



Resistance to parasites (cont'd)

- EBVs of rams calculated and used by the breeding program
- Offspring from 50% top sires (resistant +) to excrete on average half as many parasite eggs as those from 50% bottom sires (resistant -)

  (source S. Aguerre et al., 2018)

Selection is an efficient way to increase resistance and resilience to nematodes challenge in sheep.

- Short term: use resistant AI rams in flocks with resistance to treatments
- Medium term: include resistance and resilience in TMI to improve the population.

Similar approach is underway in goats

Benefice from international cooperation increasingly highlighted

Adaptation and resilience traits: hard-to-measure traits, less phenotypes available => smaller reference population

Interest to pool data across country to benefit from larger reference population

- International projects to assess / improve international cooperation
  - Guidelines to harmonize recording of resilience and efficiency traits
  - Tools to implement across country evaluation
  - Promote joint across country breeding programs
  - **Launch an initiative for such an international cooperation**

Conclusion

- In French dairy small ruminants, breeders are increasingly addressing the issue of selecting more adapted and more resilient sheep and goats.
- Global warming, new health challenges, demand of the society for more agro-ecological and sustainable systems are strong drivers and incentives for this impetus.
- Novel adaptation and resilience-related traits have been / are under study, thanks to various projects. Some of them might rapidly / are already included in selection criteria.
- Building more balanced breeding goals should benefit from more efficient genomic selection and also from international cooperation.
- Emphasize the strength of joining research and development, academics and stakeholders inputs.

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