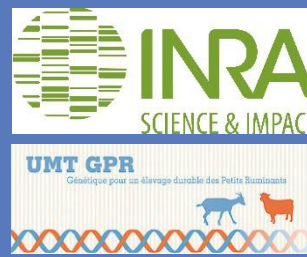




Innovation for Sustainable
Sheep and Goat
Production in Europe



Task 5.1 Animal phenotypes for resilience, adaptability and sustainability

Genotype by Environment interactions in dairy sheep and goat in France

iSAGE Training Course and Workshop

Zaragoza, Spain, from 10 to 13 December 2019

Diane BUISSON - *Institut de l'Elevage - France*

Isabelle PALHIÈRE & Hélène LARROQUE – *INRA - France*

A new issue in breeding

- Actual hypothesis in genetic evaluation : there are no genotype by environment interactions
 - Best animals are the same whatever the environment
- **Is genetic selection for production well adapted to all environments ?**
 - Characterization of environments
 - Analyse of Genotype by Environment interactions (GxE)
 - Heritability according to environments
 - Genetic correlations accross environements for a given trait

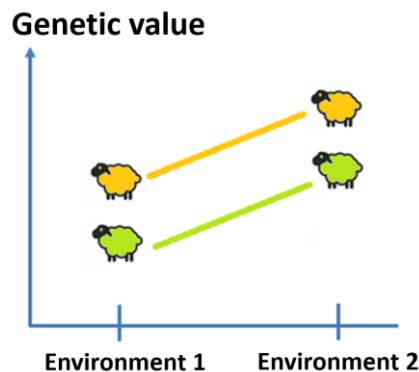
What is a GxE interaction ?

There is a GxE interaction when individual genetic value vary accross environments

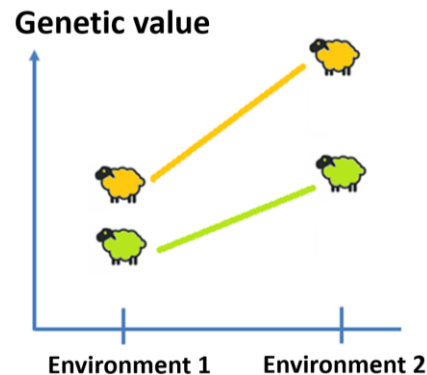
→ **Analyse** : the trait analysed is considered different accross environments

Adaptation of selection to all type of environments

No GxE interactions

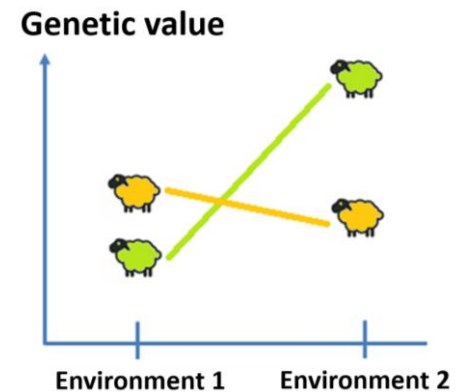


GxE : Scale effect



≠ Heritability

GxE : Reclassification



Genetic correlations < 1

< 1

Characterization of production environments

Breeding characteristics

Livestock management

Animal performances

Genetic evaluations
(EBV & flock effects)



Dairy sheep
(Lacaune)



Campaigns 2012-2015
N=143 flocks

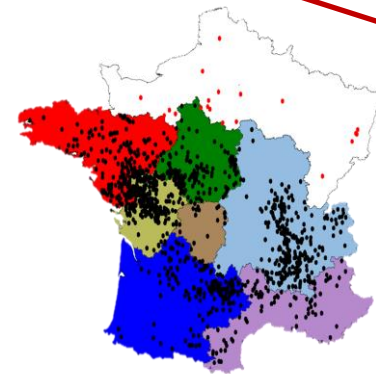
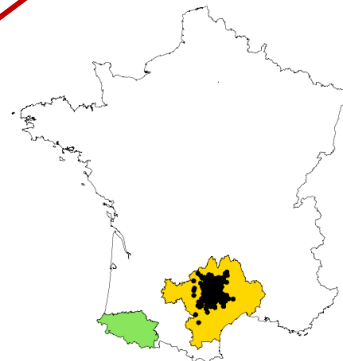


Dairy Goat
(Alpine, Saanen)



Campaigns 2014-2016
N=432 flocks

Breeding system



Meteorological data

THI

Indicators of grass growth



Typology of environments in Lacaune

Cluster 1 (38 flocks): Ségala

Early milking
Low milk production in early milking
High FC & PC
Breeding effects low for MY and high
for FC & PC

Cluster 2 (32 flocks) : Rougiers/Ségala

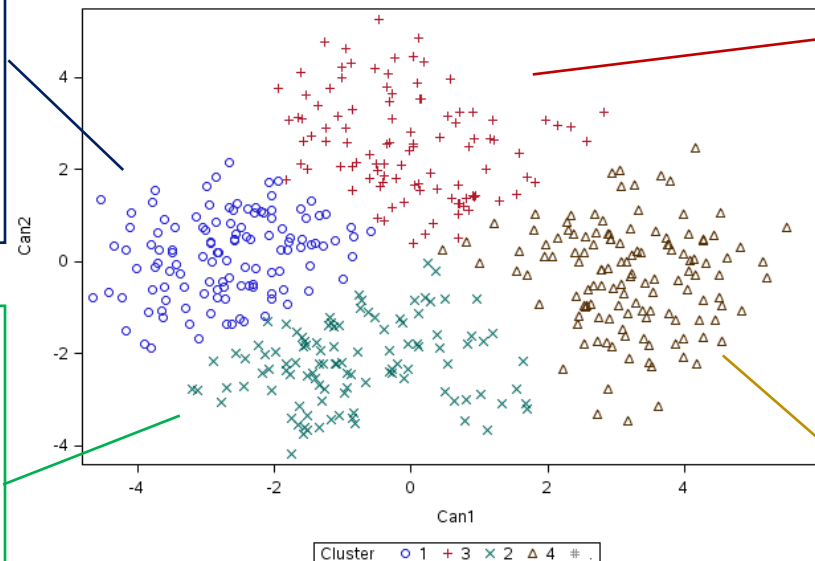
Low altitude (good grass growth in
spring)
High milk production in early milking
Low feeding costs

Cluster 3 (33 flocks): Lévezou

High altitude (few grass in spring)
High quantity of distributed fodder
and concentrates
High feeding costs

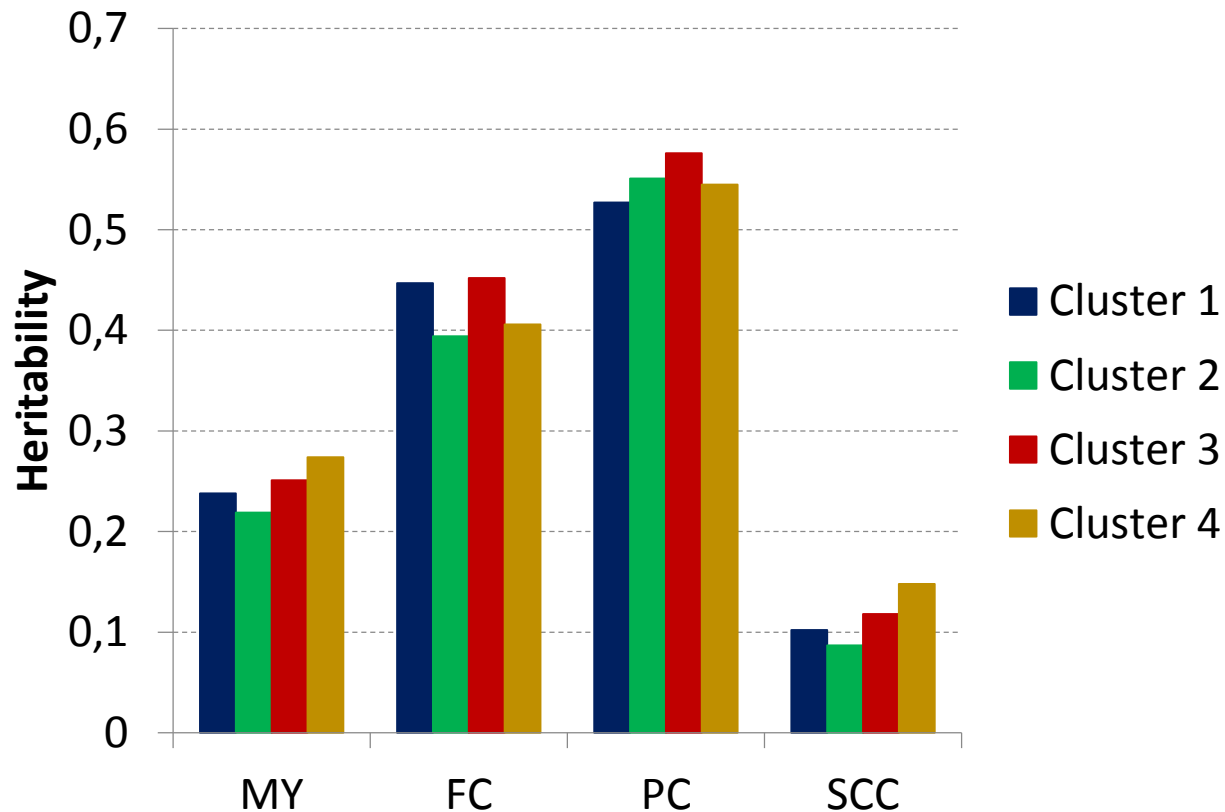
Cluster 4 (40 flocks): Causses Sud

Late milking
Shorter lactations
Low FC & PC
Low breeding effects for MY, FC & PC
Low quantity of distributed fodder
and concentrates





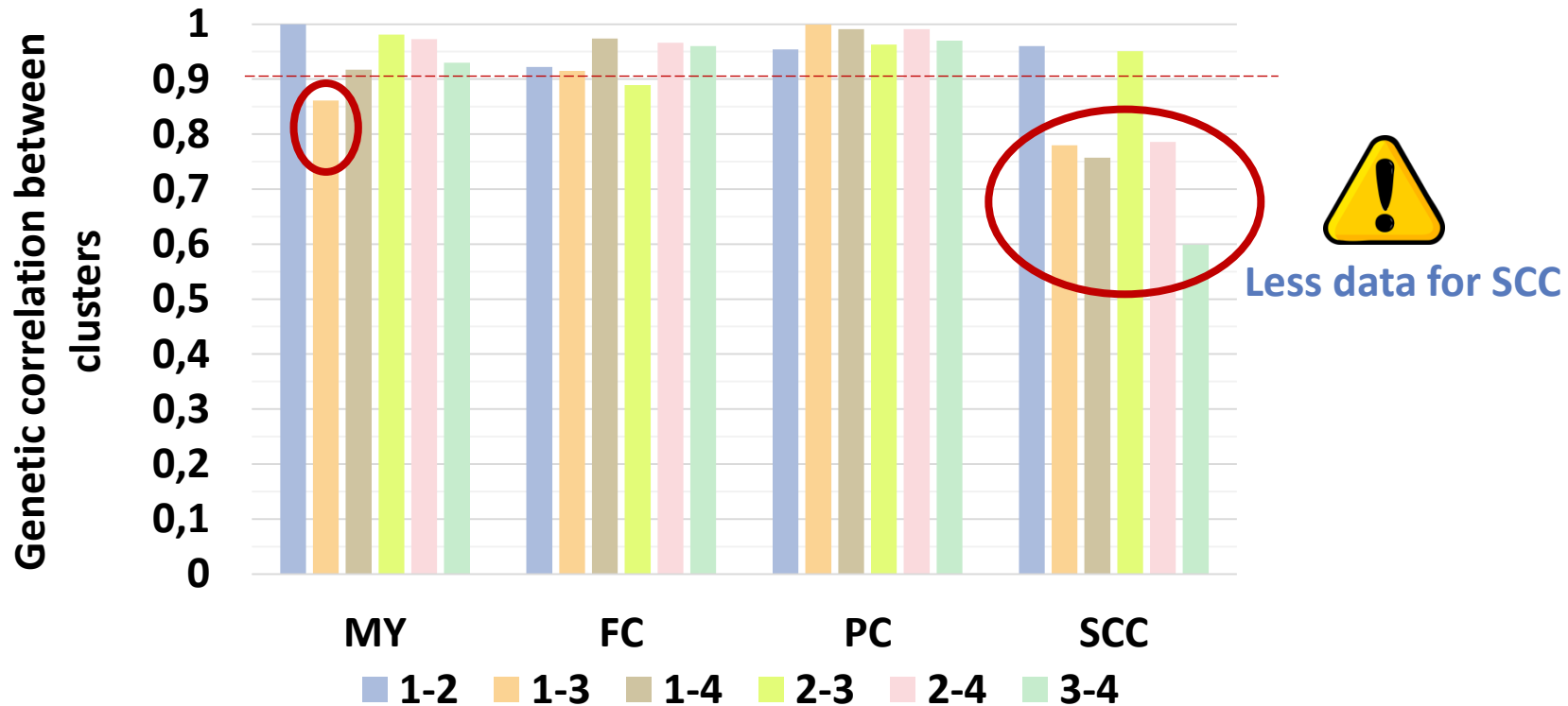
GxE Interactions : low scale effect in Lacaune



Heritability of traits are very close in all clusters



GxE interactions : few reclassifications in Lacaune



High genetic correlations between clusters

except for MY (between clusters 1 & 3)

except for SCC

Typology of environments in Goat

Cluster 1 (100 flocks) Dairy farmers from Poitou-Charentes

Main breed : Saanen
High milk production
High genetic values
Long lactations
Hay
Field crops

Cluster 3 (144 flocks) Dairy farmers from Bretagne / Pays de la Loire

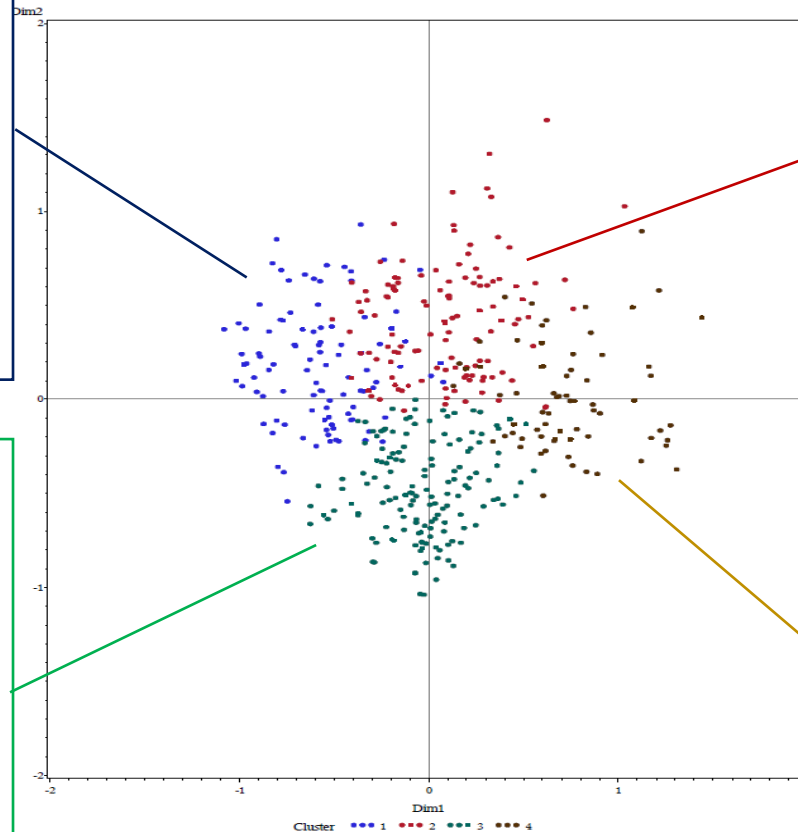
Main breed : Alpine
Big flocks
High milk production
Silage (maize, grass) and wrapping
High % AI

Cluster 2 (119 flocks) Dairy and mixt breeders from Centre / Rhones Alpes / Auvergne / Bourgogne

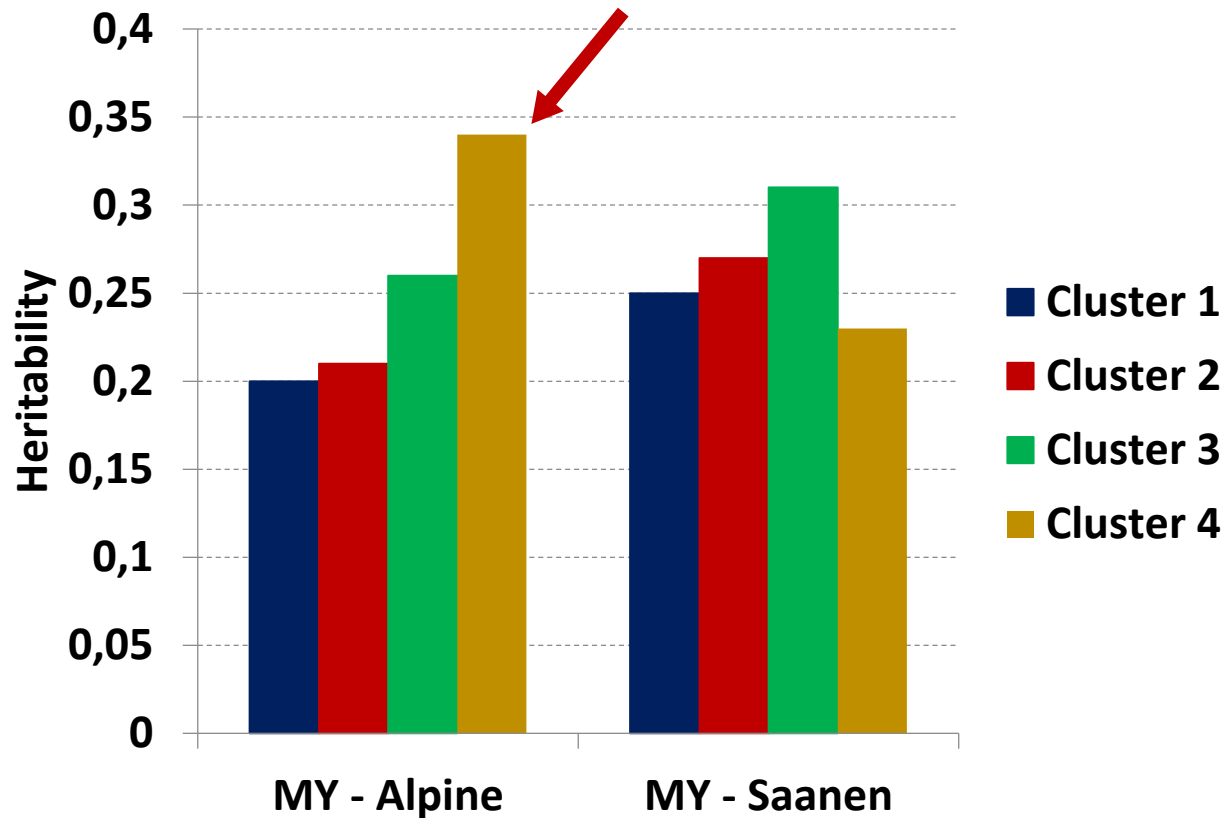
Main breed : Alpine or mixt
High FC & PC
Hay
Low % of daughters from AI

Cluster 4 (69 flocks) Cheese farmers from PACA / Languedoc / Rhones Alpes

Main breed : Alpine
Small flocks
Low milk production
Seasonned lambing
Grazing, hay, pastoralism
Low connexion

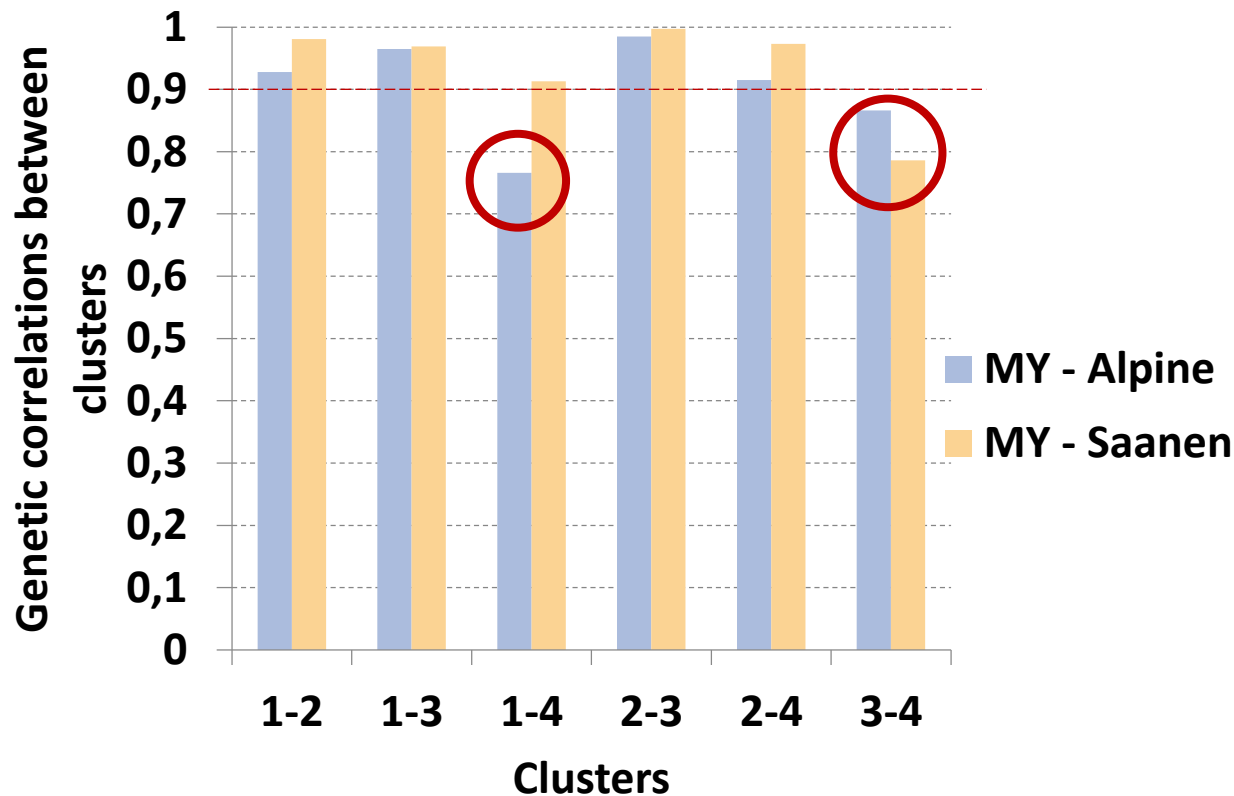


GxE Interactions : low scale effect in goat



Significant differences of heritability in Alpine breed for cluster 4...
... but genetic variance quasi identical between clusters

GxE interactions : few reclassifications in goat



High genetic correlations between clusters

except for cluster 4 (cheese farmers, small flocks) :



Small number of females

Conclusion

- Few GxE interactions as scale effect in both species
 - Except for Alpine from cheese farming system
 - *To be confirmed with more data*
 - Few GxE interactions as reclassifications
 - Except for SCC in Lacaune and for cheese farmers in dairy goat (few data)
 - *To be confirmed with more data*
- In most cases, actual evaluation seems to allow selection of best reproductive animals whatever the environment / breeding system...**
- ... but it has to be confirmed for traits or clusters where there wasn't enough data in this study**