Characterization of dairy sheep and goats production systems in France:
First step for a GxE study

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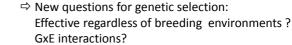[2] Institut de l'Elevage, 31326 Castanet-Tolosan, France

Introduction

Breeding dairy small ruminants in France:

⇨ News practices:
↗ herd feed resources → → feed autonomy
+ concerned by environment and societal demands
⇨ Diversity of pedoclimatic conditions

⇨ New questions for genetic selection:
Effective regardless of breeding environments ?
GxE interactions?

Objective: first step for a GxE study
Categorization of environment
Using a multiple-trait herd cluster analysis based on a large panel of descriptors (from the animal to the system)

Materials and methods

Dairy Goats 🐐

1136 herds ⇨ 514
2 main breeds

Saanen
Alpine

Dairy Sheep 🐑

1001 flocks ⇨ 637

Western Pyrenean
Blond faced Manech
Basco-Béarnais

Roquefort area
Lacaune

Corsica island
Corsica breed

Characteristics of animals
Number of females
Breed(s)
Average phenotypic levels (milk, fat and protein contents, SCC)

EBVs & herd-year effects
Milk yield, Fat and protein contents, SCC

Herd-year identification
Geolocation
Herd in nucleus or in production
Area of production

Available data

Farming system
Feeding system
Cheese maker/supplier to industry
Reproductive season
Amount of forages and concentrates distributed (Lacaune)
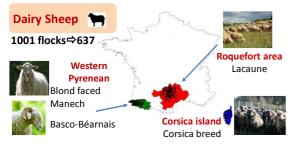Indoor and pasture periods

Meteorological data
THI
Grass growth indicator

Herd-year management
%AI
% females in 1st lactation
Age at 1st lambing/kidding
Average age of the herd
Evolution of flock size
Lambing/kidding periods
Milking only/suckling period
AI Fertility
% of long lactations
Interval between kidding

- **Selection** of the most discriminating variables (within breed in sheep):
  Principal component analysis (PCA), Multiple correspondence analysis (MCA)
- **Cluster** analysis:
  Based on the MCA components for each herd
- **Test** of the significant differences between clusters for the selected variables
(SAS® software)

Results

Breeds (number of herds)	Lacaune (300)	Basco-béarnais (84) Blond-faced Manech (218)	Corsica (35)	Goats – Alpine & Saanen (514)
Number of clusters	4	4 / 7	3	4
Discriminating variables	• Geographical location • Precocity of grass growth (altitude) • Amount of distributed concentrate and forages (Lacaune)	• Location-altitude • Rate of 1st lactation at 2 years • Flock size	• Location-altitude • Milk yield level • Artificial insemination rate	• Geographical location (West→East) • Breeding goal (milk yield/composition) • System of sales (cheese maker/deliverer) • Herd size • Reproduction organization (out of season or not)

Conclusion

Main discriminating factors of environments:
- Geographical location (Lacaune, goats), altitude (precocity of grass growth)
- Herd breeding goal: milk yield/composition
- Herd management: size, rate of 1st lactations at 2 years-old
- System of sales and of feeding (Goats)
- Amount of concentrate and forages (Lacaune)

Next step:
Are these contrasted breeding practices and conditions a source of GxE interactions?