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CLUSTERING AND GENETIC ANALYSIS OF BODY CONDITION SCORE AND BODY WEIGHT VARIATIONS IN MEAT SHEEP

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González-García E.³

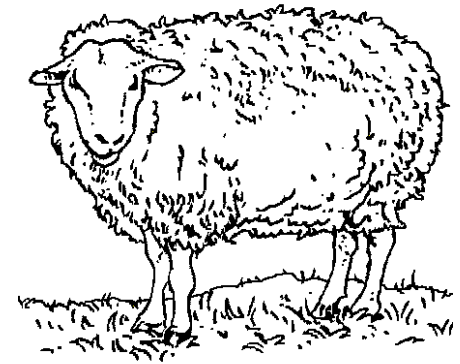
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Plan

- Context - Robustness
- Cluster analysis
 - Materials and methods
 - Results
- Genetic analysis
 - Creation of new traits
 - Materials and methods
 - Results
- Discussion – Conclusion
- Perspective



Robustness

- Robust animals to assure the farm sustainability in harsh condition

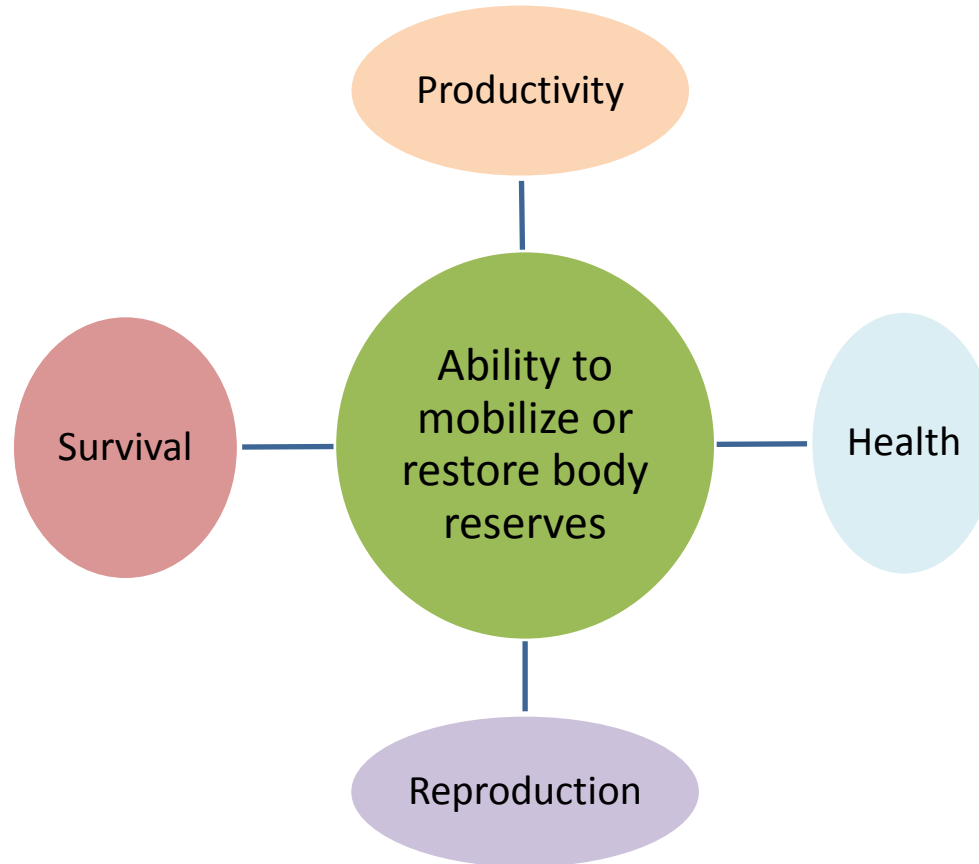


Ability to
mobilize or
restore body
reserves

Russel *et al.*, 1971
Blanc *et al.*, 2006

Robustness

- Robust animals to assure the farm sustainability in harsh condition



Russel *et al.*, 1971
Blanc *et al.*, 2006

Robustness – Body Condition Score and Body Weight

- Body Condition Score (BCS) and BW to characterize robustness
 - BCS: grid from 1 to 5
 - Capacity of mobilization or accretion of body reserves (BR)

- Heritability
 - BCS
 - From 0.10 to 0.30 for Targhee ewes

 - Body Weight (BW)
 - From 0.30 to 0.56 for adult sheep

- No study on genetic for BCS and BW variations across productive cycle

Borg *et al.*, 2005
Gizaw *et al.*, 2007
Loker *et al.*, 2011
Shackell *et al.*, 2011

Robustness – Body Condition Score and Body Weight

➤ Objectives

- To characterize the different patterns of BCS and BW variation during productive cycle and career
- To analyze the genetic variability of BCS and BW changes throughout several productive cycles

Materials and Methods

- La Fage: meat Romane flock (n=250 ewes) reared exclusively outdoors in harsh conditions

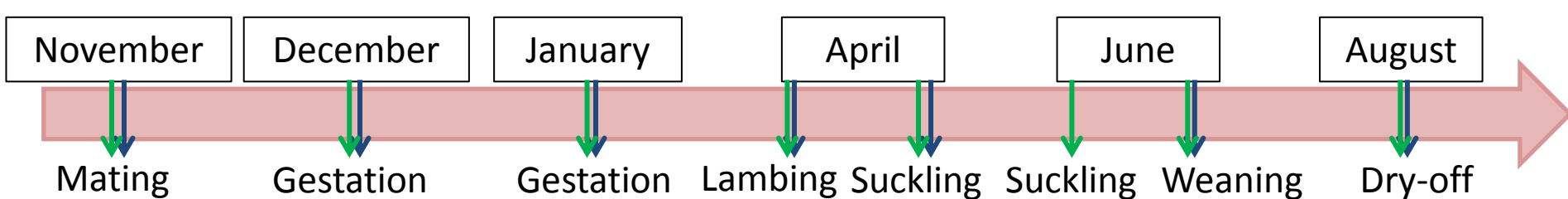


Materials and Methods

- La Fage: meat Romane flock (n=250 ewes) reared exclusively outdoors in harsh conditions
- BCS and BW measured on 1448 ewes from 78 sires (2002-2015)
 - Cycle 1: 1448
 - Cycle 2: 1170
 - Cycle 3 and more: 665

Materials and Methods

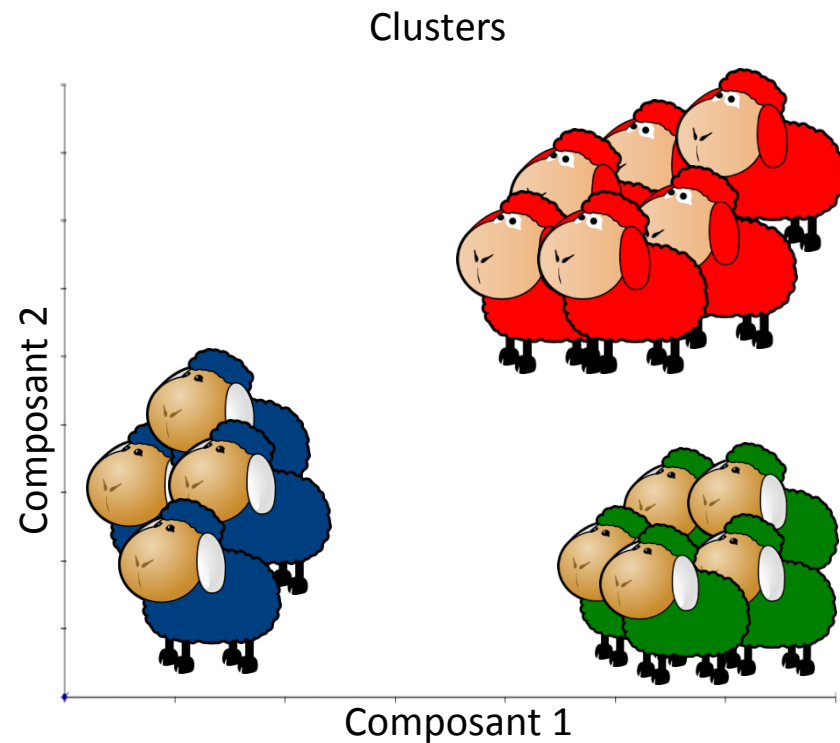
- La Fage: meat Romane flock (n=250 ewes) reared exclusively outdoors in harsh conditions
- BCS and BW measured on 1448 ewes from 78 sires (2002-2015)
 - Cycle 1: 1448
 - Cycle 2: 1170
 - Cycle 3 and more: 665
- **8 BCS** and **7 BW** measurements per production cycle



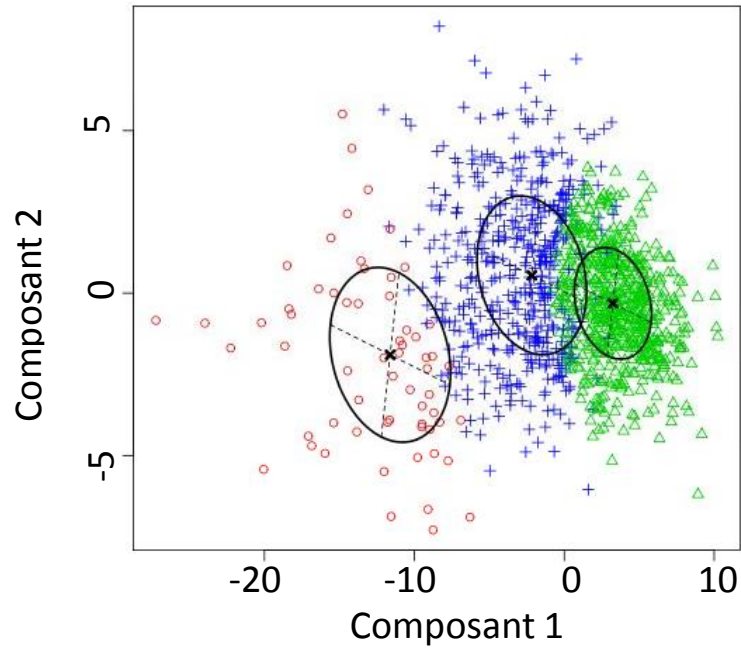
Materials and Methods – Cluster analysis

➤ Clustering

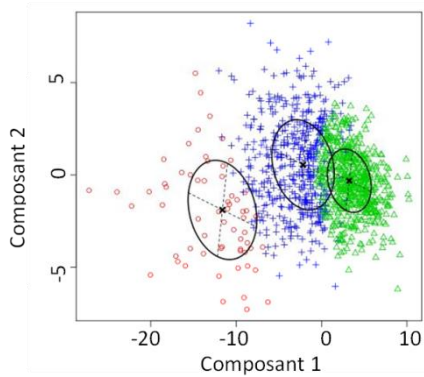
- To describe profiles
- Smoothing
- PCA
- Clusters construction
 - Expectation-Maximization Algorithm



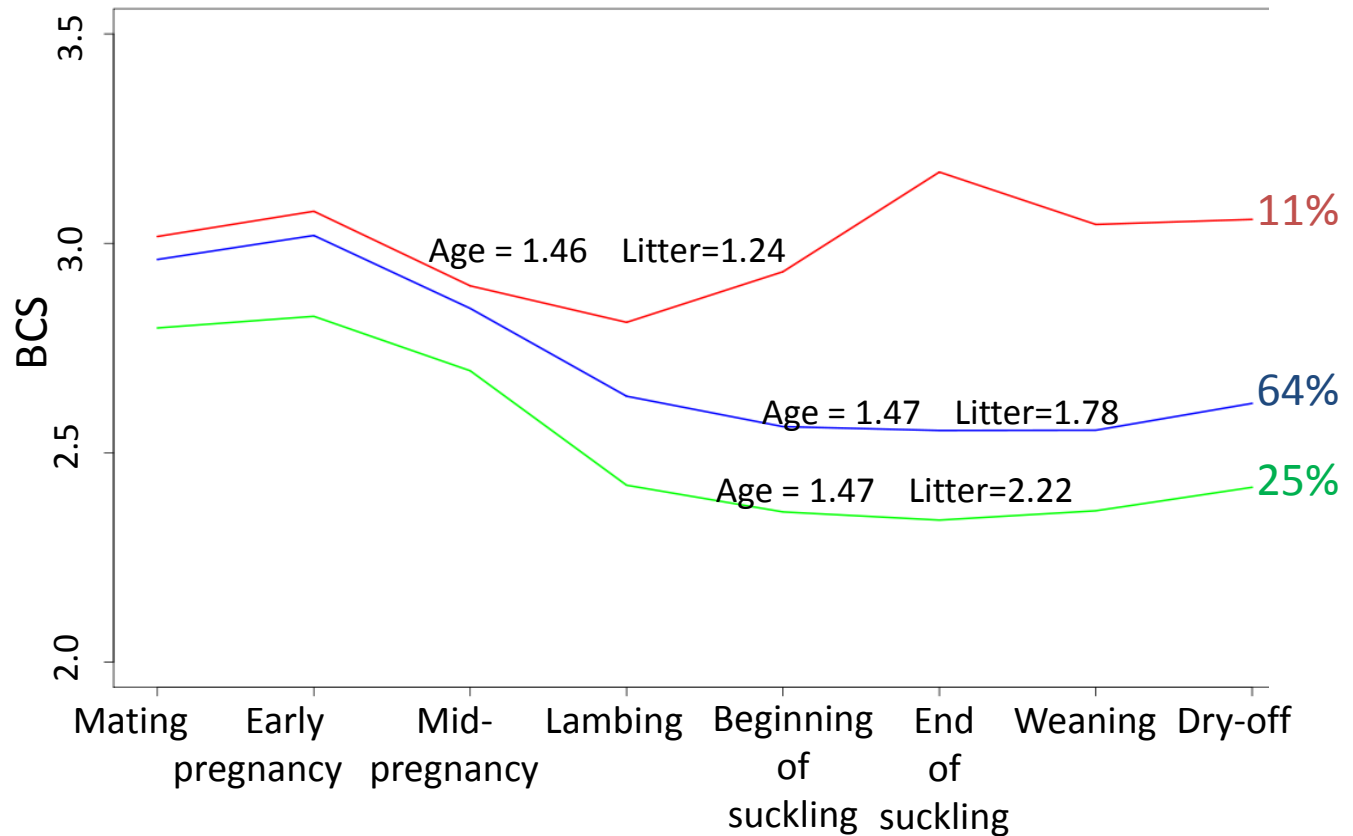
Results for BCS Clusters



Results for BCS Clusters

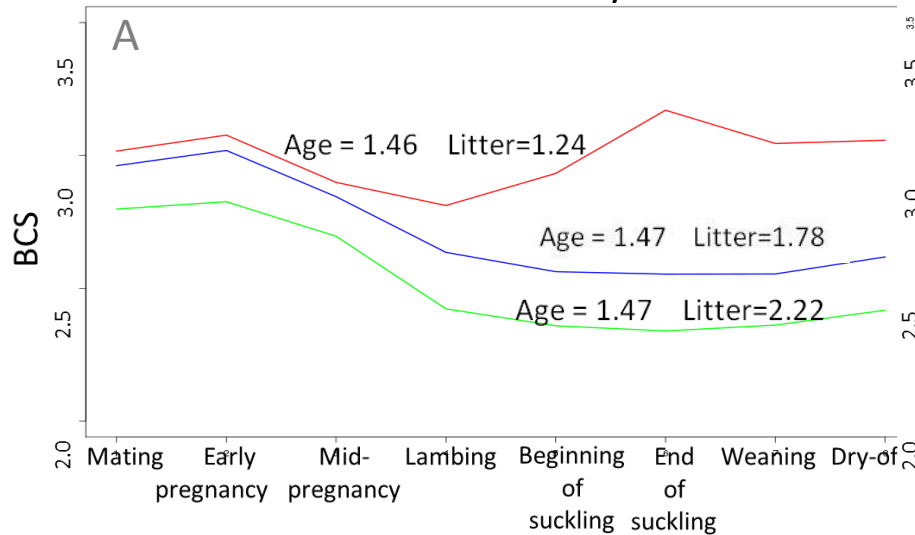


BCS clusters for cycle 1

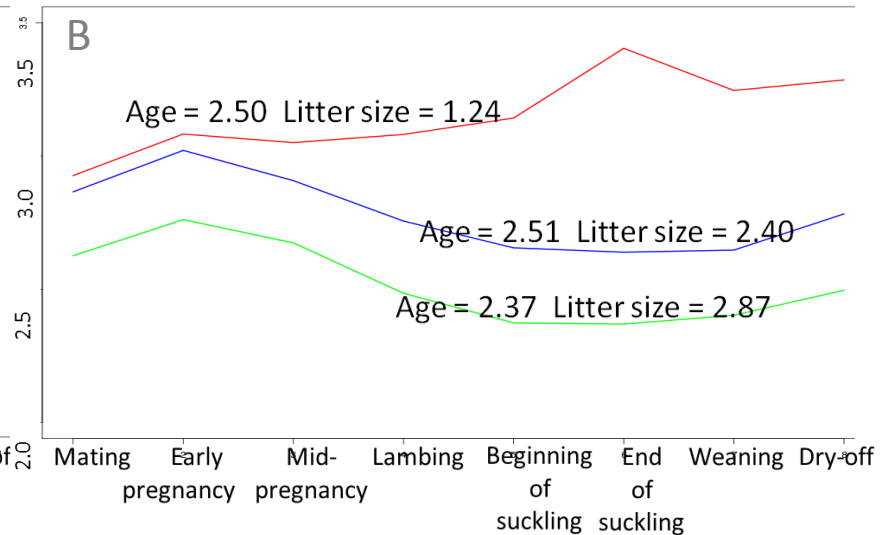


Results for BCS Clusters

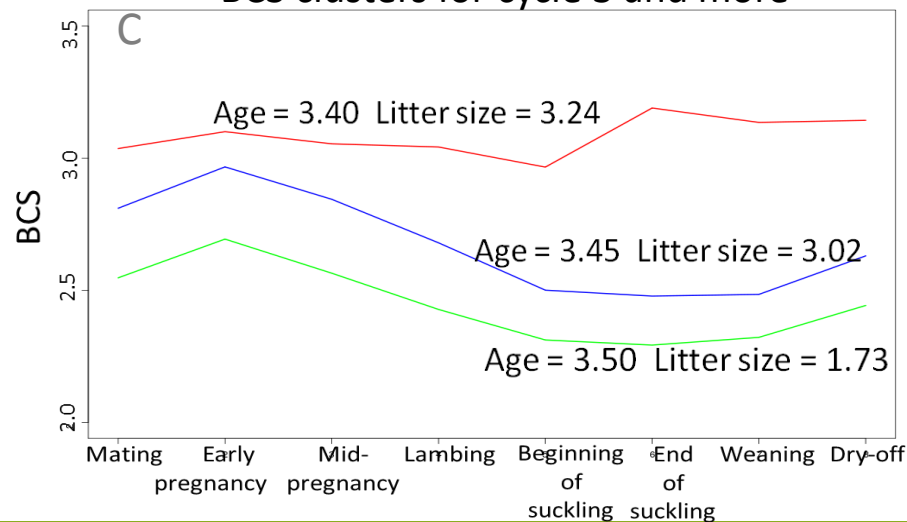
BCS clusters for cycle 1



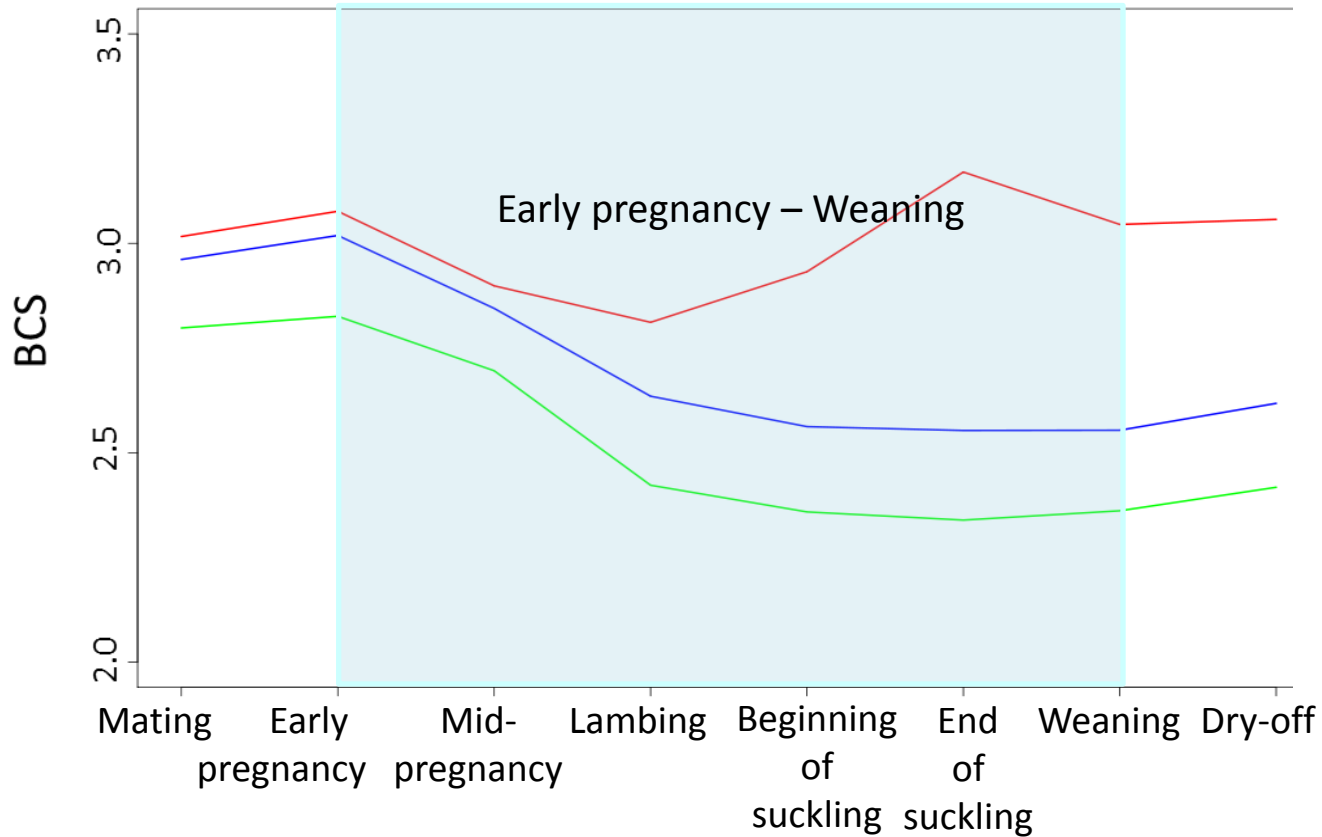
BCS clusters for cycle 2



BCS clusters for cycle 3 and more

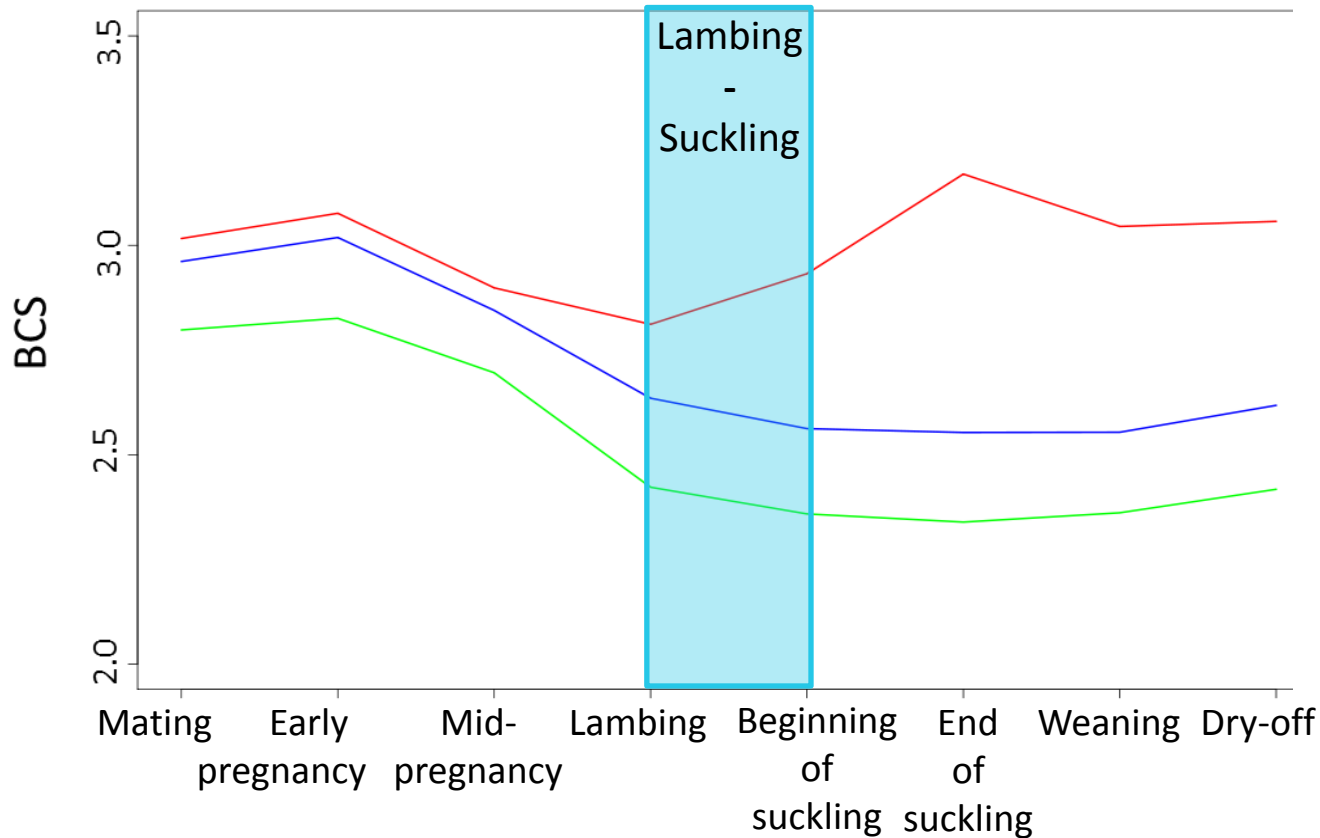


Creation of new traits



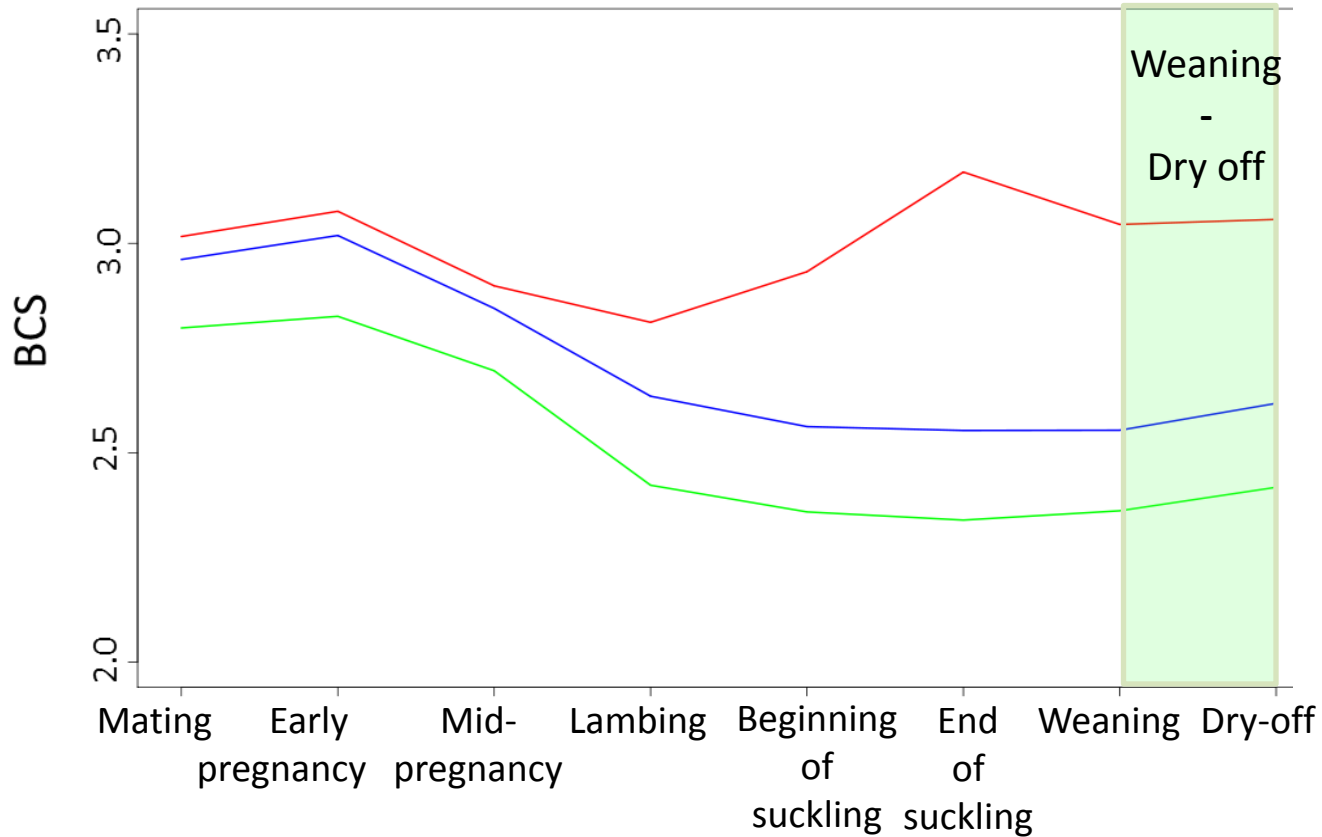
$$Y = BCS_{\text{Weaning}} - BCS_{\text{Early Pregnancy}}$$

Creation of new traits



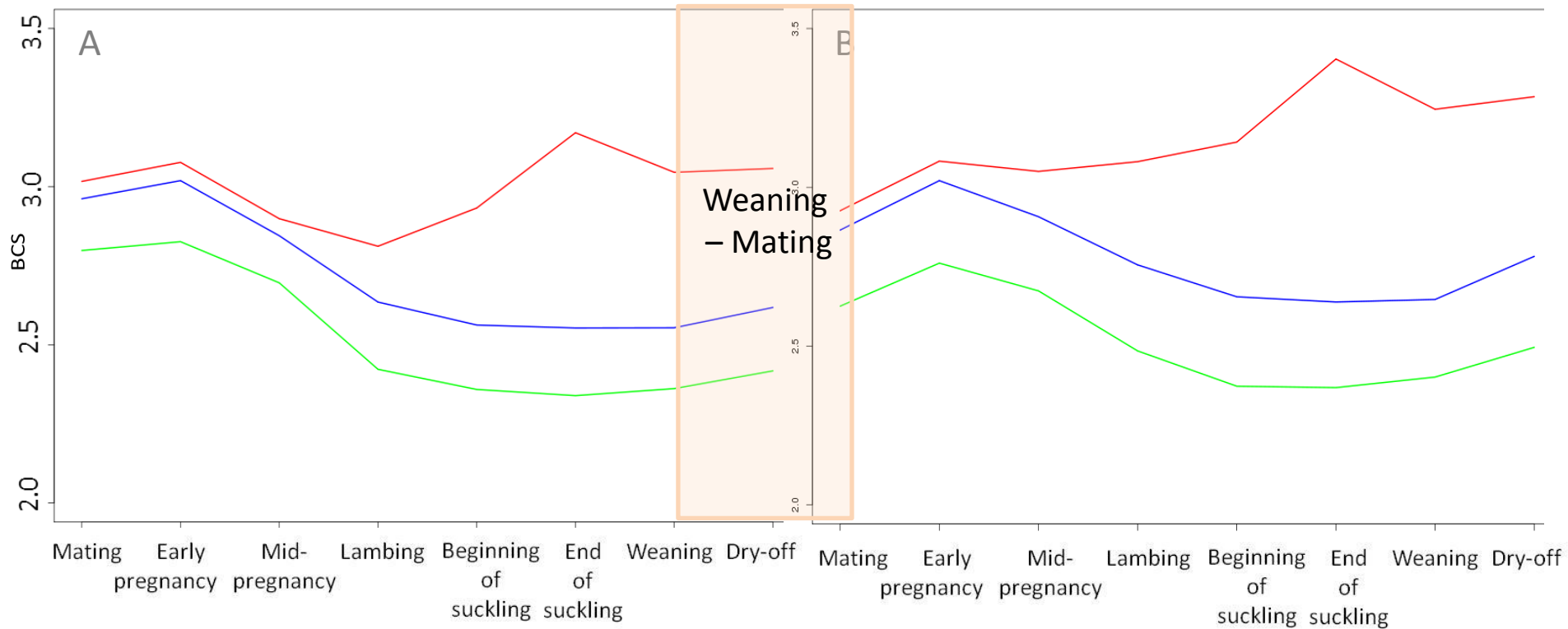
$$Y = BCS_{\text{Suckling}} - BCS_{\text{Lambing}}$$

Creation of new traits



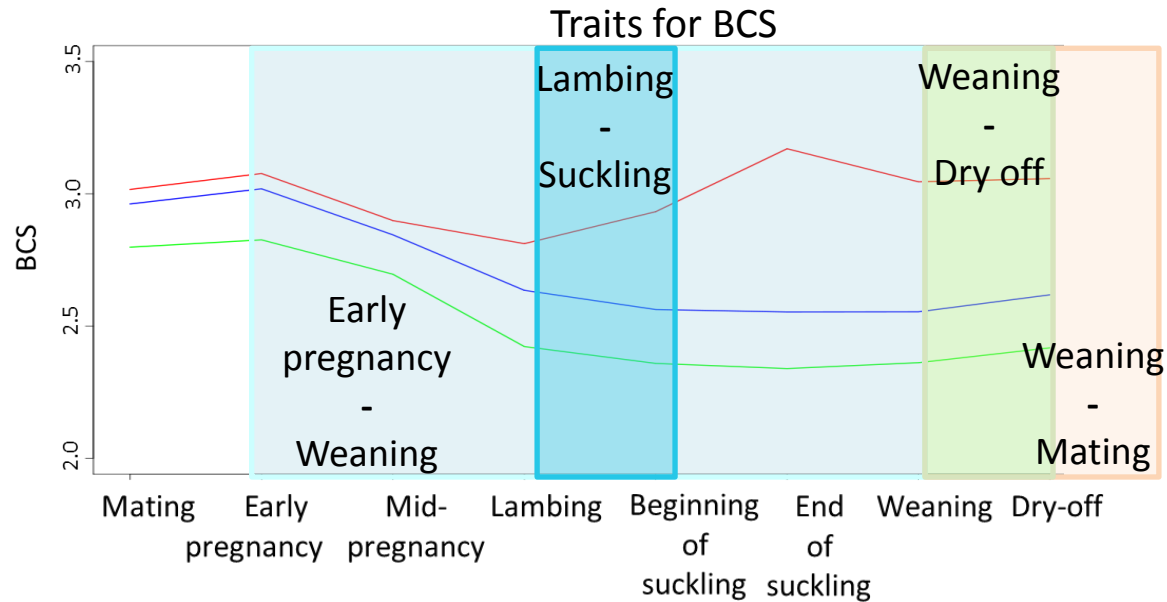
$$Y = BCS_{\text{Dry off}} - BCS_{\text{Weaning}}$$

Creation of new traits



$$Y = BCS_{\text{Mating}} - BCS_{\text{Weaning}}$$

Materials and Methods – Genetic Analysis



- Univariate and multivariate analysis (animal model): Heritabilities and correlations estimation with (ASReml), use of all cycles

$$Y = \mu + \text{animal} + \text{perm} + \text{age} + \text{parity} + \text{litter} + \text{year} + e$$

Y: trait

μ : mean of the trait

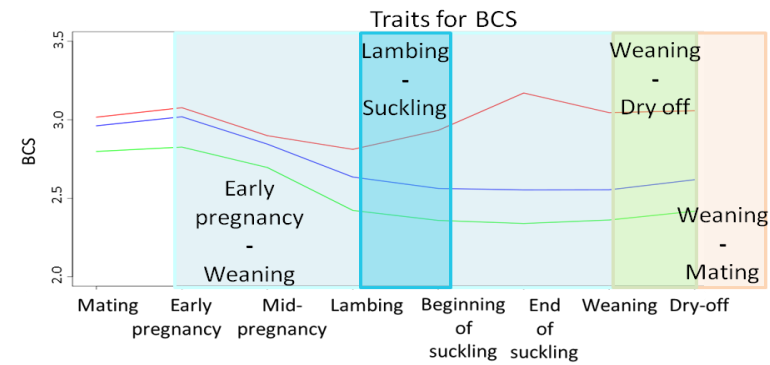
animal: additive genetic effect of the ewe

perm: environmental permanent effect of the ewe

age of the ewe, parity, litter, year of measurements as fixed effects

e: residual

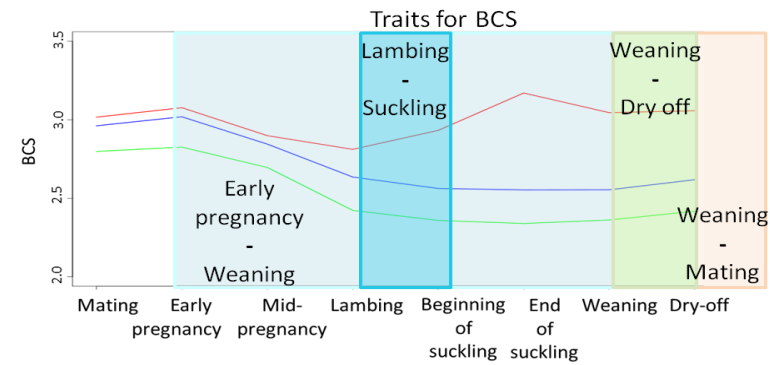
Results



- Low to medium heritabilities (0.06 ± 0.01 to 0.15 ± 0.01)
- Positive correlations between periods characterizing BR mobilization

Variables BCS	Lambing - Suckling
Early pregnancy - Weaning	0.49 (0.12)

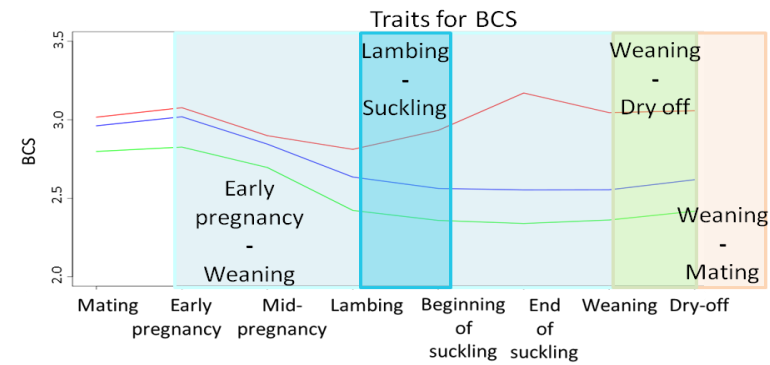
Results



- Low to medium heritabilities (0.06 ± 0.01 to 0.15 ± 0.01)
- Positive correlations between periods characterizing BR mobilization
- Positive correlations between periods characterizing BR accretion

Variables BCS	Weaning - Mating
Weaning – Dry off	0.75 (0.10)

Results



- Low to medium heritabilities (0.06 ± 0.01 to 0.15 ± 0.01)
- Positive correlations between periods characterizing BR mobilization
- Positive correlations between periods characterizing BR accretion
- Negative correlations between periods characterizing BR accretion and mobilization

Variables BCS	Weaning – Dry off
Early pregnancy - Weaning	-0.71 (0.08)
Lambing - Suckling	-0.46 (0.12)

Discussion - Conclusion

- BCS: three similar profiles across productive cycles
- BCS and BW variations heritable: first demonstration
- Increase in weight during dry-off correlated to heavier lambs
- Accretion and mobilization of BR linked at the genetic level
 - Common genes?

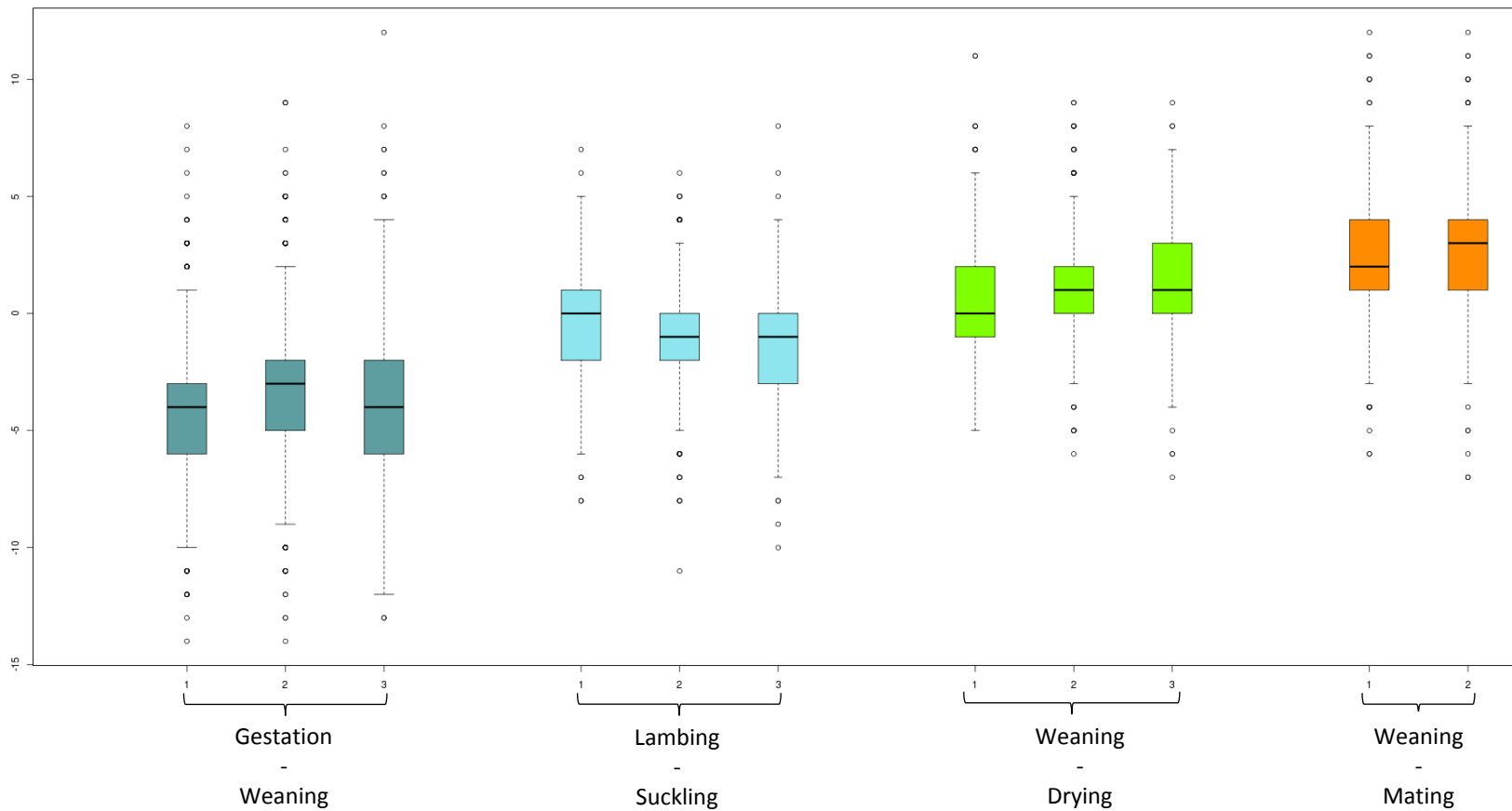
Discussion - Conclusion

➤ Perspectives

- Modelisation of the variations profiles (BCS and BW)
- Longitudinal genetic analysis with reaction norm model
- Joint analysis with climatic data (reaction norm model)
- Better phenotyping for BR variations (key metabolites /hormones /ultra sound...)

Thanks for your attention





Results

