

Analysis of goat lactation curves in France

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**Food and Agriculture
Organization of the
United Nations**



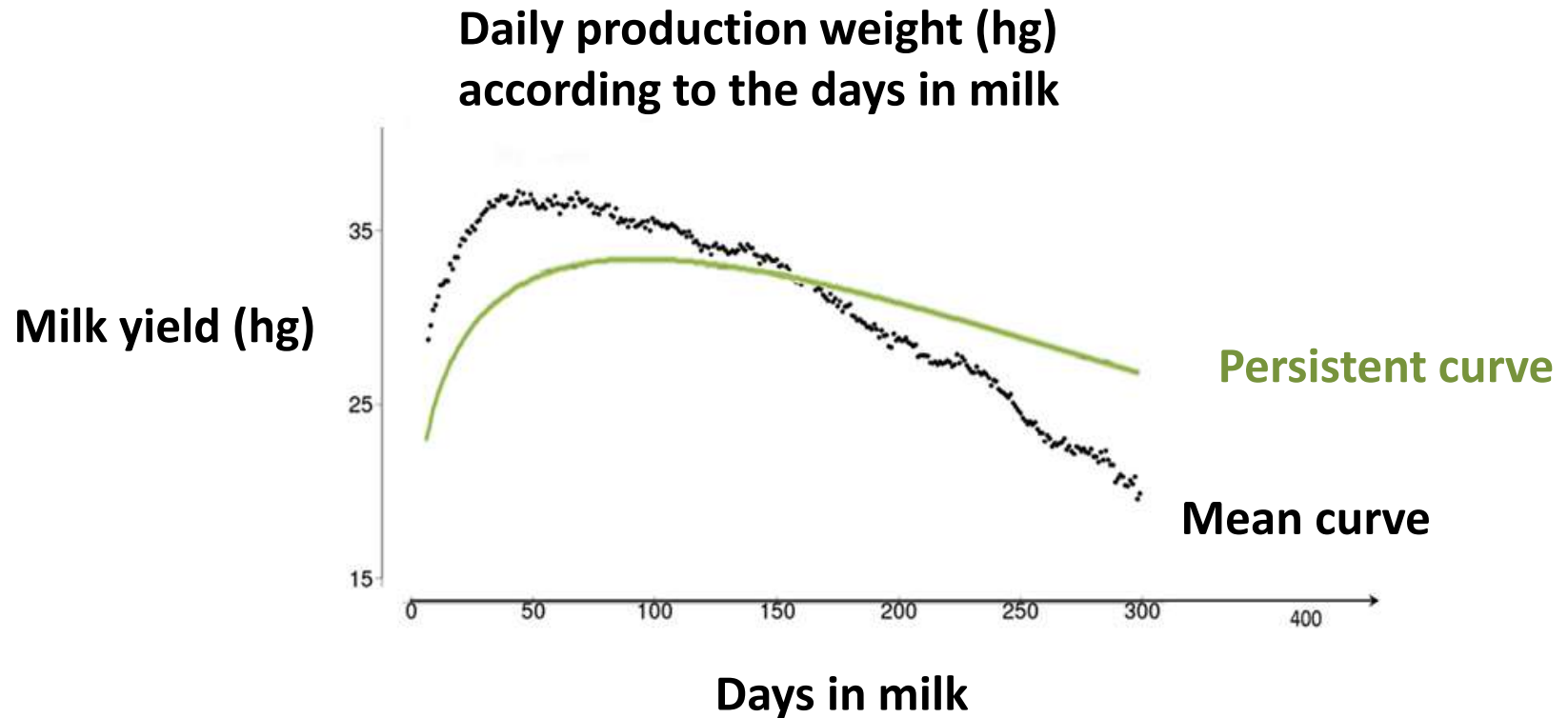
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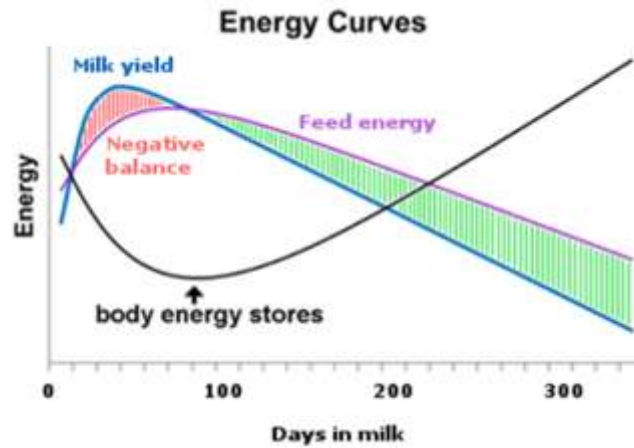


A lactation curve represents the daily production according to the lactation stage



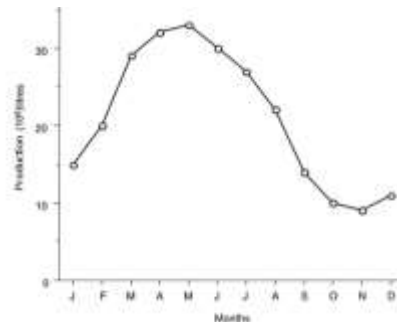
The shape of the lactation curve is of interest for the repartition of feed needs

From Strucken et al. (2015)



Importance of negative balance

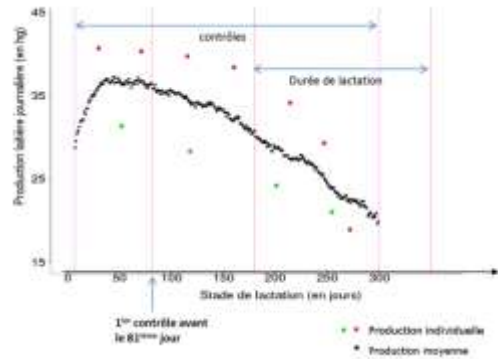
Repartition of milk production



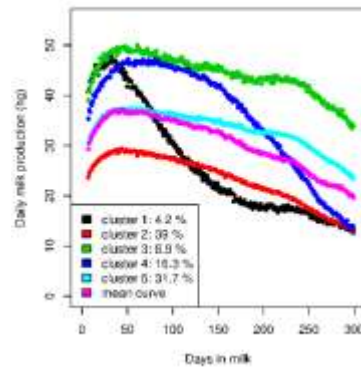
From Chemineau et al. (1996)



This presentation focuses on the shape of the lactation curve



Data presentation



Clustering of lactation curves based on their shapes



The impact of different factors on the shape of lactation curves

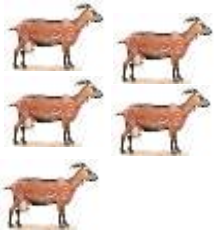
Data: Selection from the national dairy test-day database

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Production of about 2000 herds measured every 4 to 5 weeks



2 weighings per check
At least 4 controls per lactation



5 goats of the same breed per herd per control



Saanen



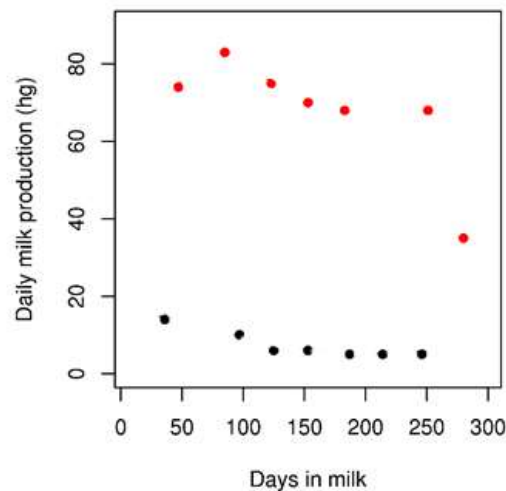
Alpine

Final data : Years 2009 to 2011 (213 000 goats, 324 547 lactations)

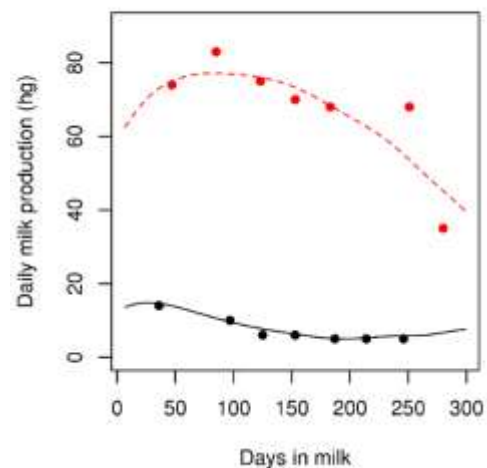
Curves classification

Goat milk production is not measured at the same lactation stage but the information is not averaged by period

Functional data



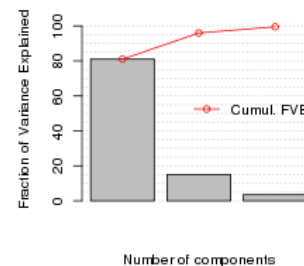
Local linear regression



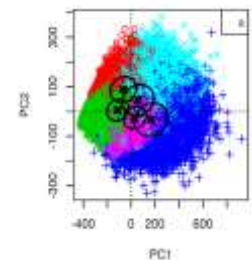
Package R "fdapace" (Dai et al., 2016)



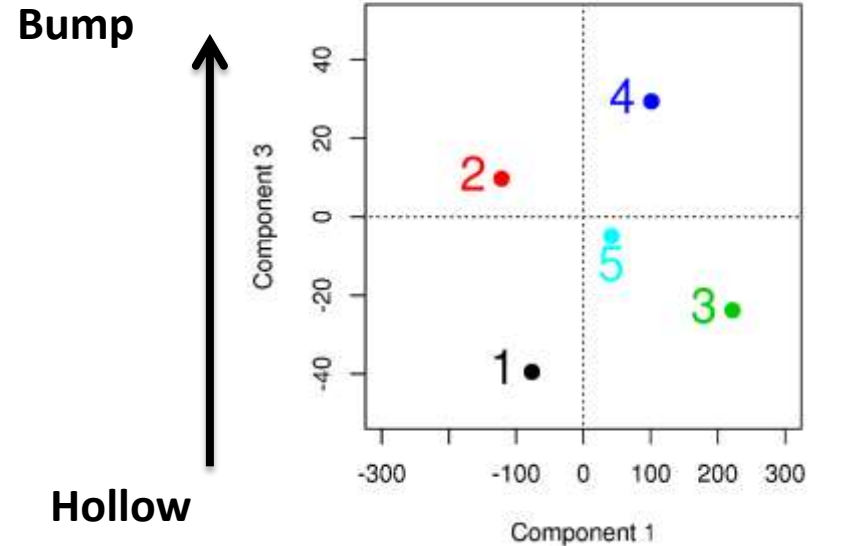
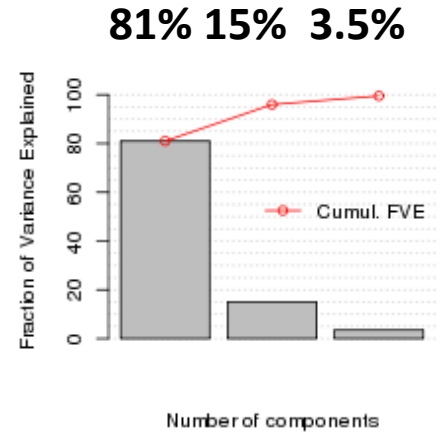
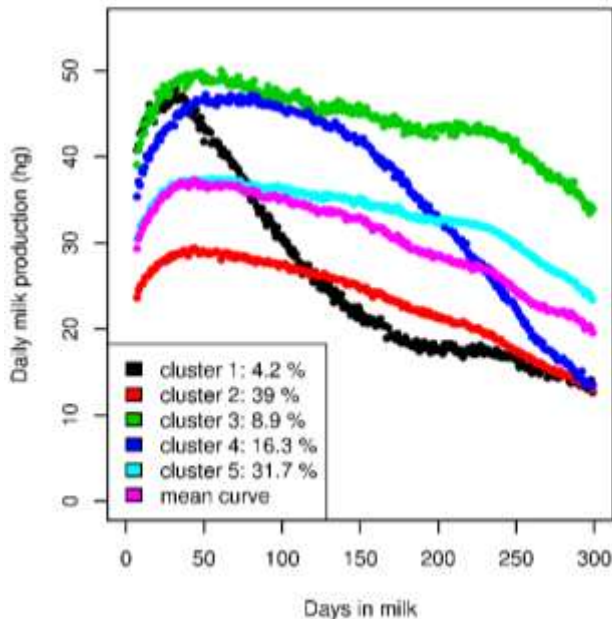
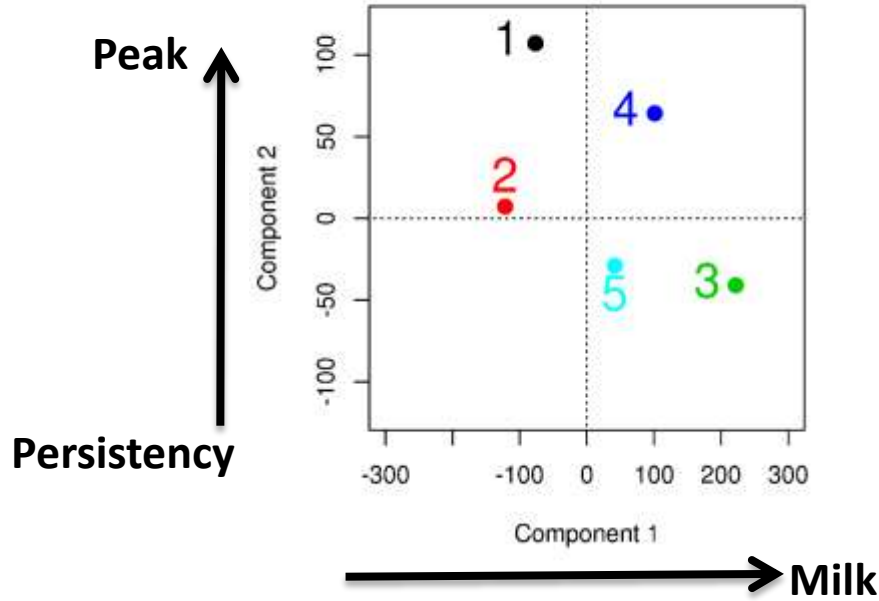
PCA



Clustering



5 different curves after the classification of lactations according to the 3 components

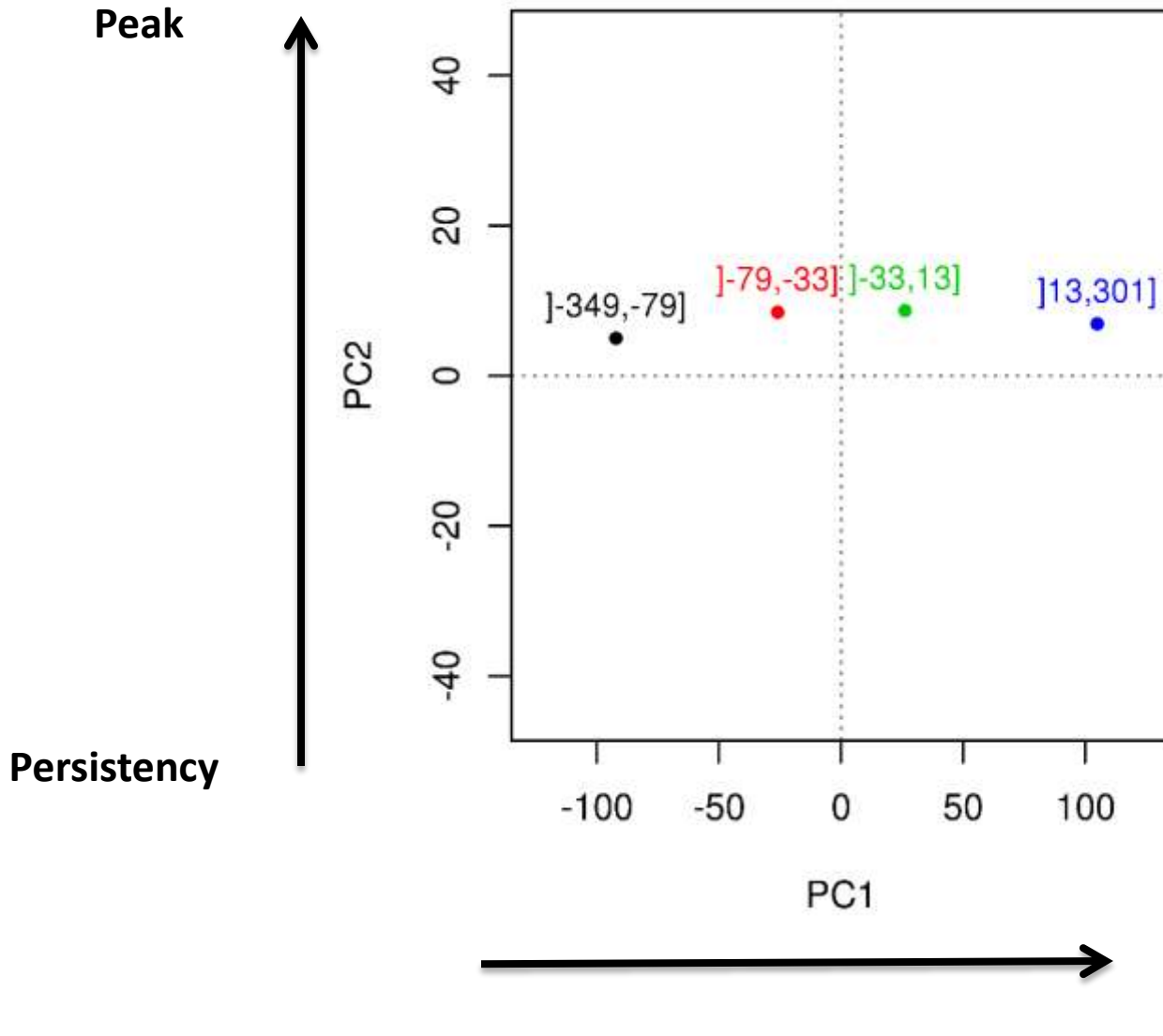


Package R Rmixmod

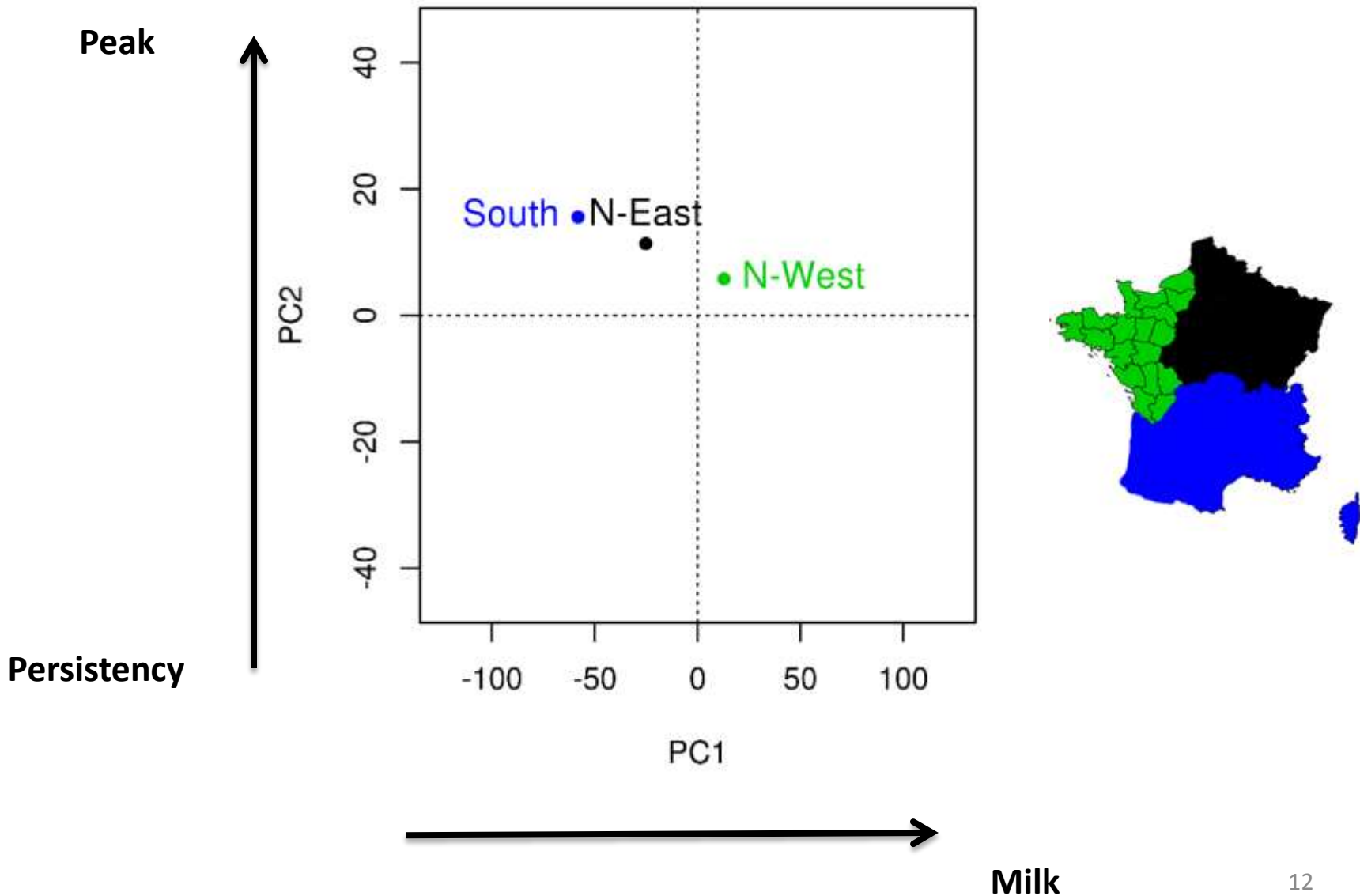
Relations between different factors and the shape of lactation curves

- **Parity**
- **Age at kidding**
- **Kidding month**
- **Dry-period length**
- **Gestation stage**
- **Breed**
- **Milk EBV**
- **Somatic Cell Score EBV**
- **Region**

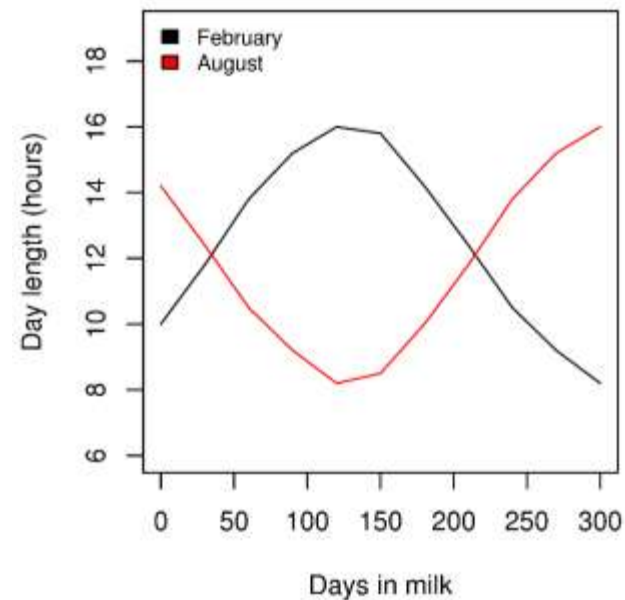
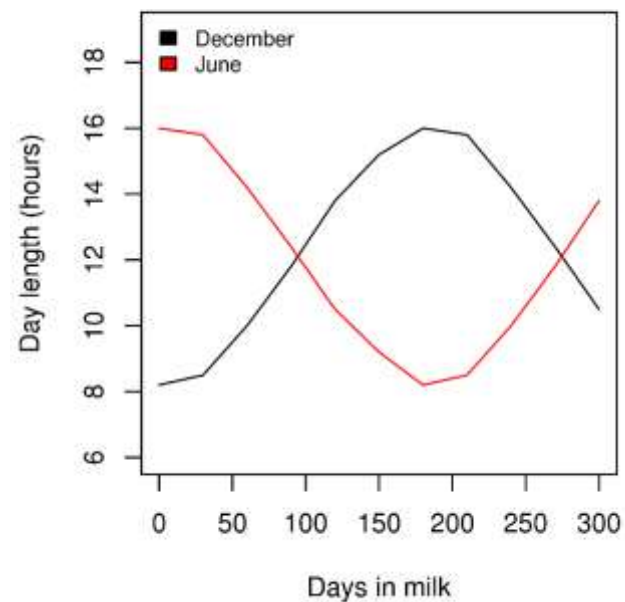
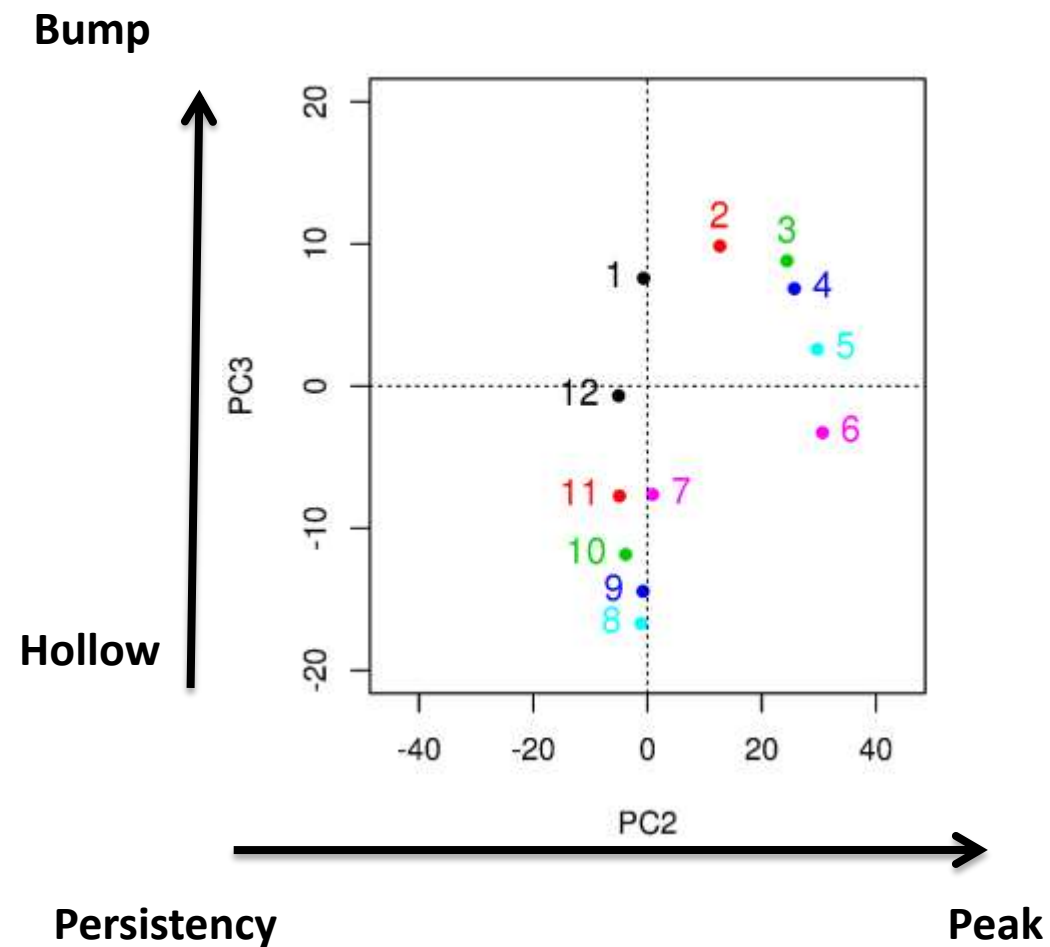
Milk Genetic index is the factor the most related to the level of production



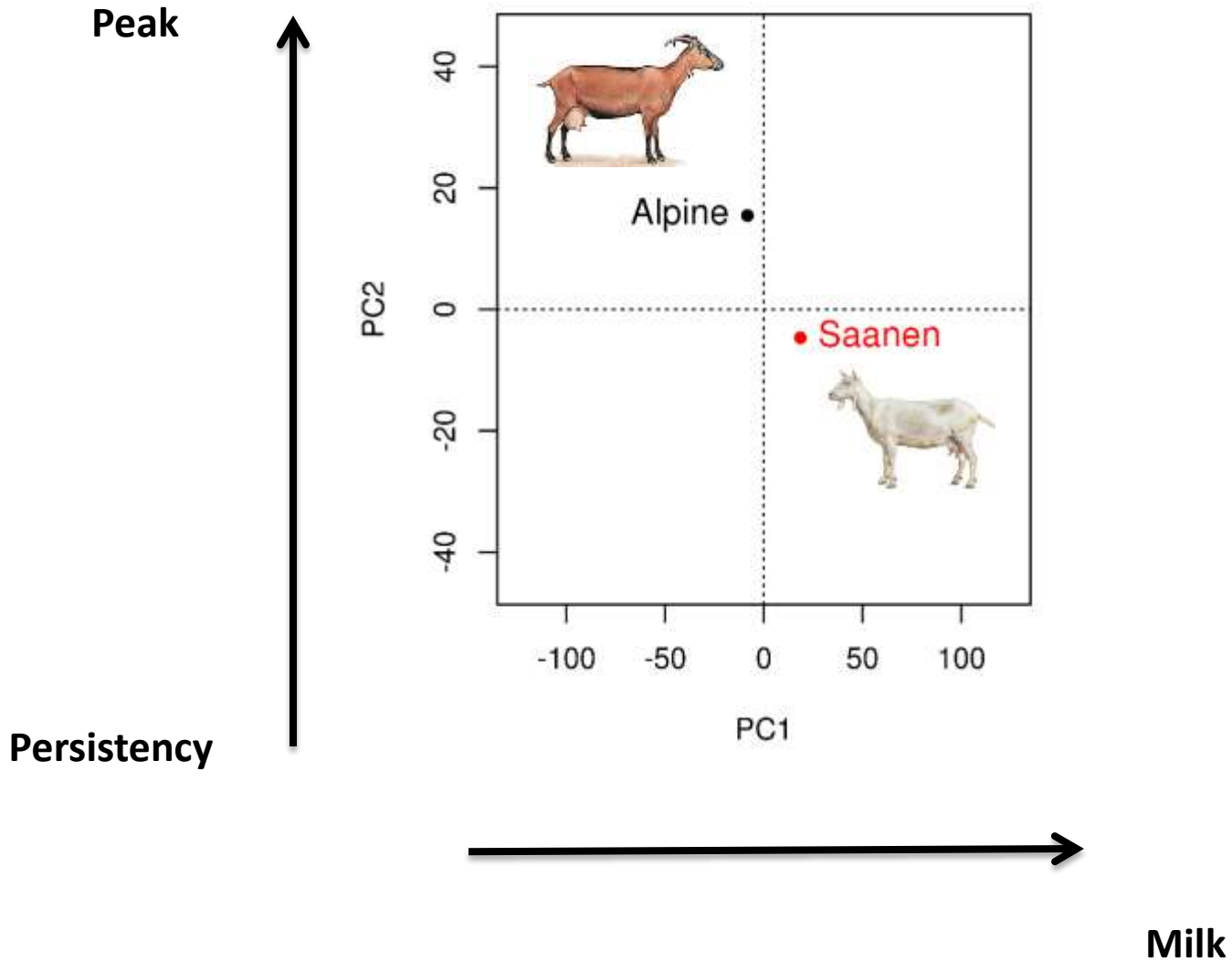
Region is the one of the factors the most related to the level of production



The kidding month is the factor the most related to the persistency and to the curvature at the middle of lactation:

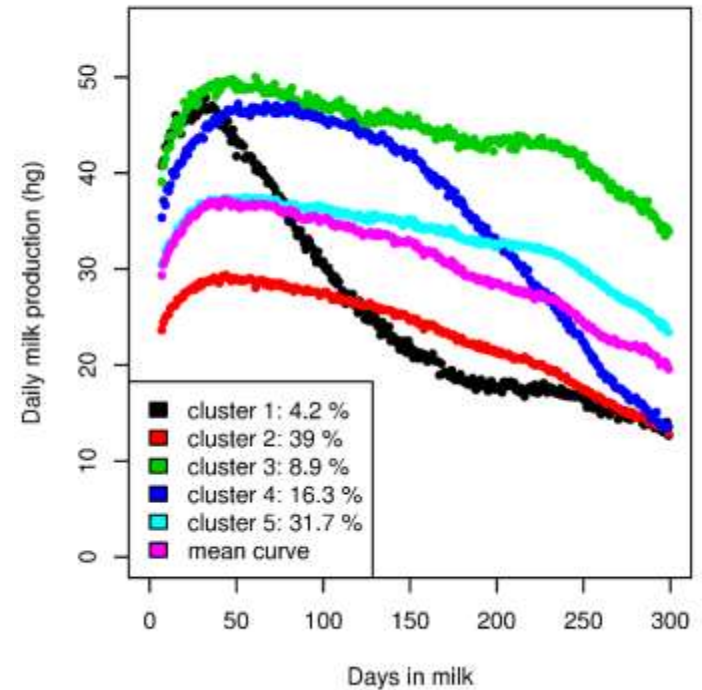


The breed is one of the factors the most related to the persistency :



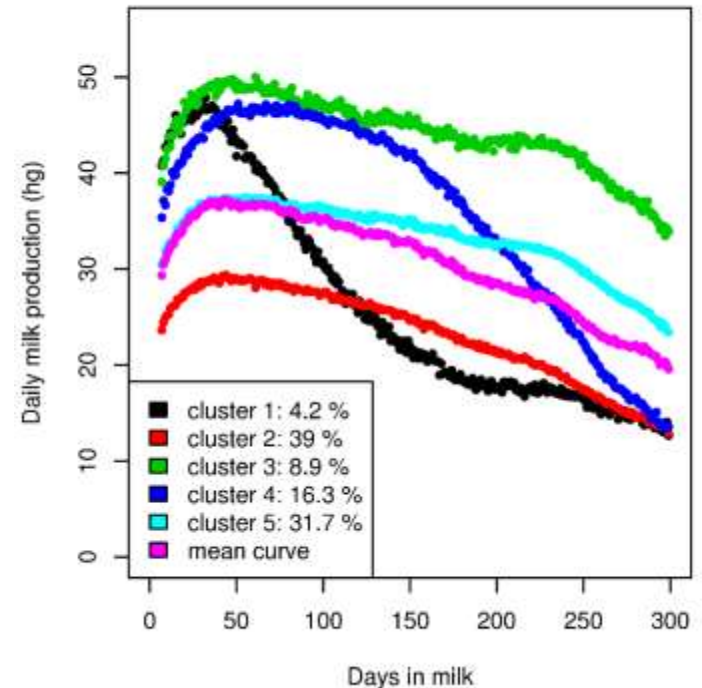
It was possible to summarize curves with a PCA, to do a classification and to study impacts of environmental factors

- **5 different shapes of curves**
- Impact of different factors :
 - **Level of production:** genetics (milk), region
 - **Persistency** : kidding month, breed
 - **Curvature at the middle of lactation:** kidding month



It was possible to summarize curves with a PCA, to do a classification and to study impacts of environmental factors

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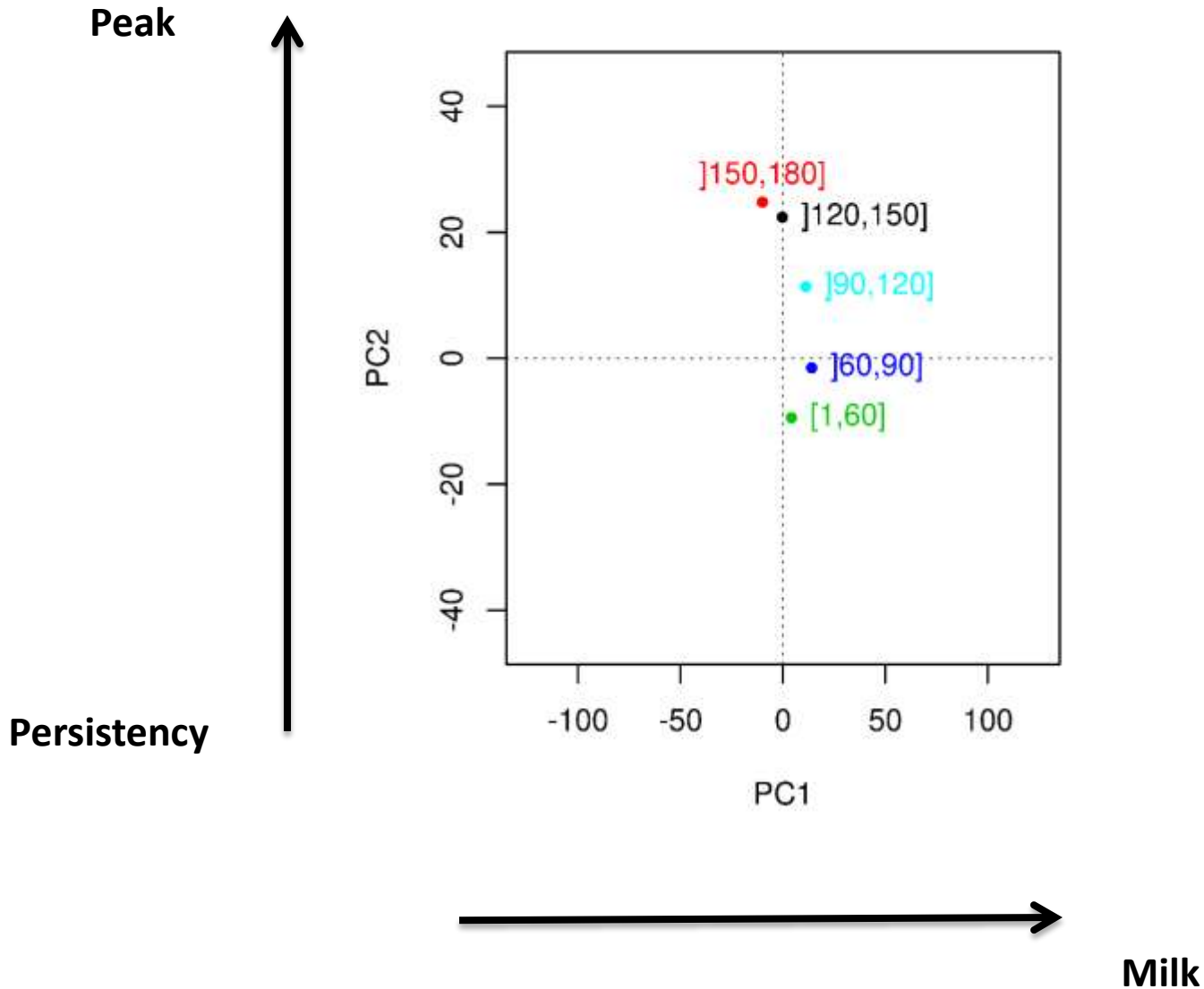


Questions ?

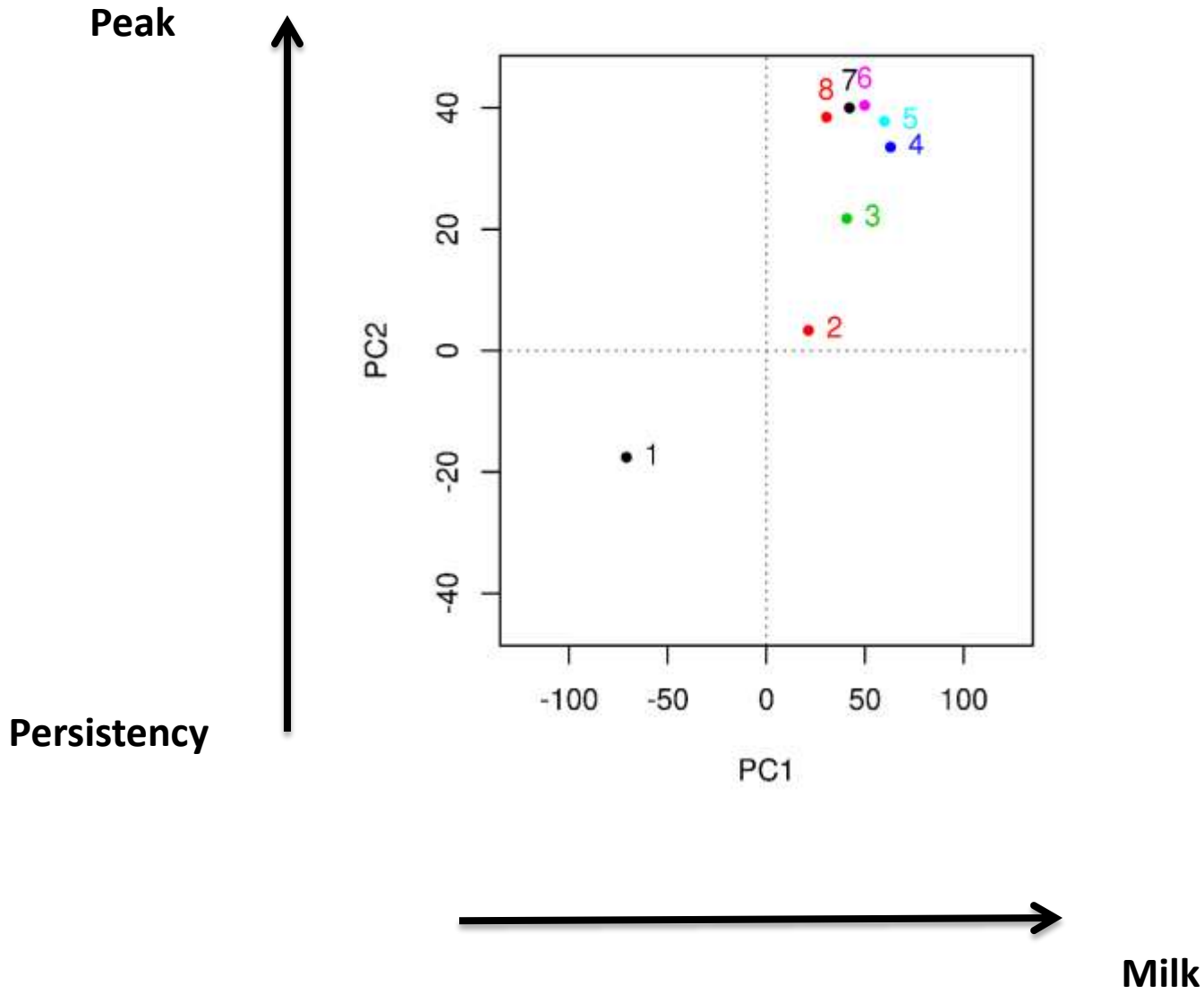
Coefficient of determination (R^2) of the complete model where the lactation scores of each principal component are explained by all the environmental factors and of the complete model reduced alternately by an environmental factor.

	PC1	PC2	PC3
Complete model	0.402	0.225	0.135
Complete model without parity	0.399	0.215	0.134
Complete model without kidding age	0.399	0.222	0.133
Complete model without kidding month	0.395	0.199	0.034
Complete model without dry-period length	0.400	0.222	0.135
Complete model without gestation stage	0.395	0.208	0.130
Complete model without breed	0.394	0.201	0.135
Complete model without milk EBV	0.161	0.224	0.135
Complete model without SCS EBV	0.401	0.219	0.135
Complete model without region	0.385	0.223	0.134

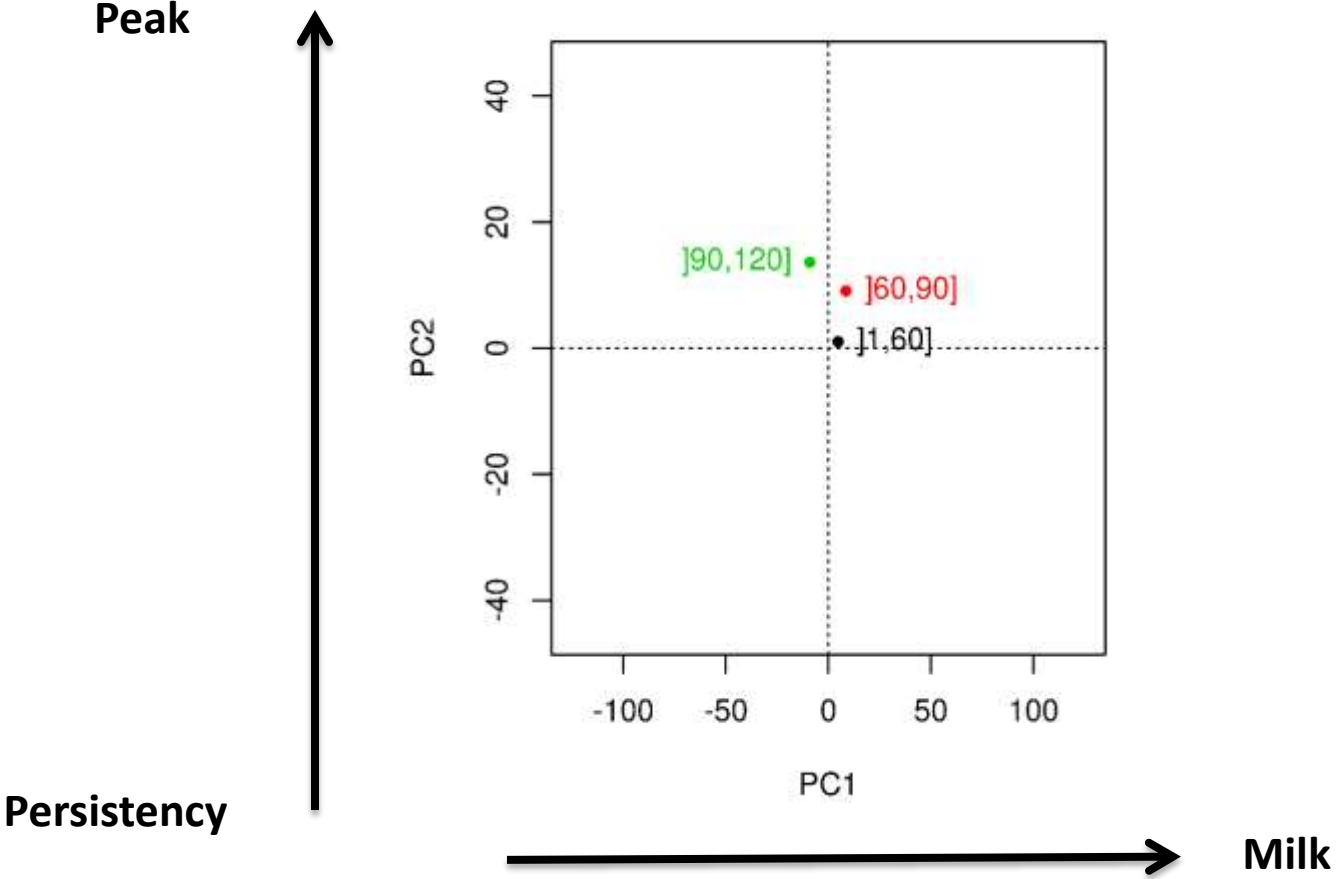
Gestation stage is one of the factors the most related to the second component:



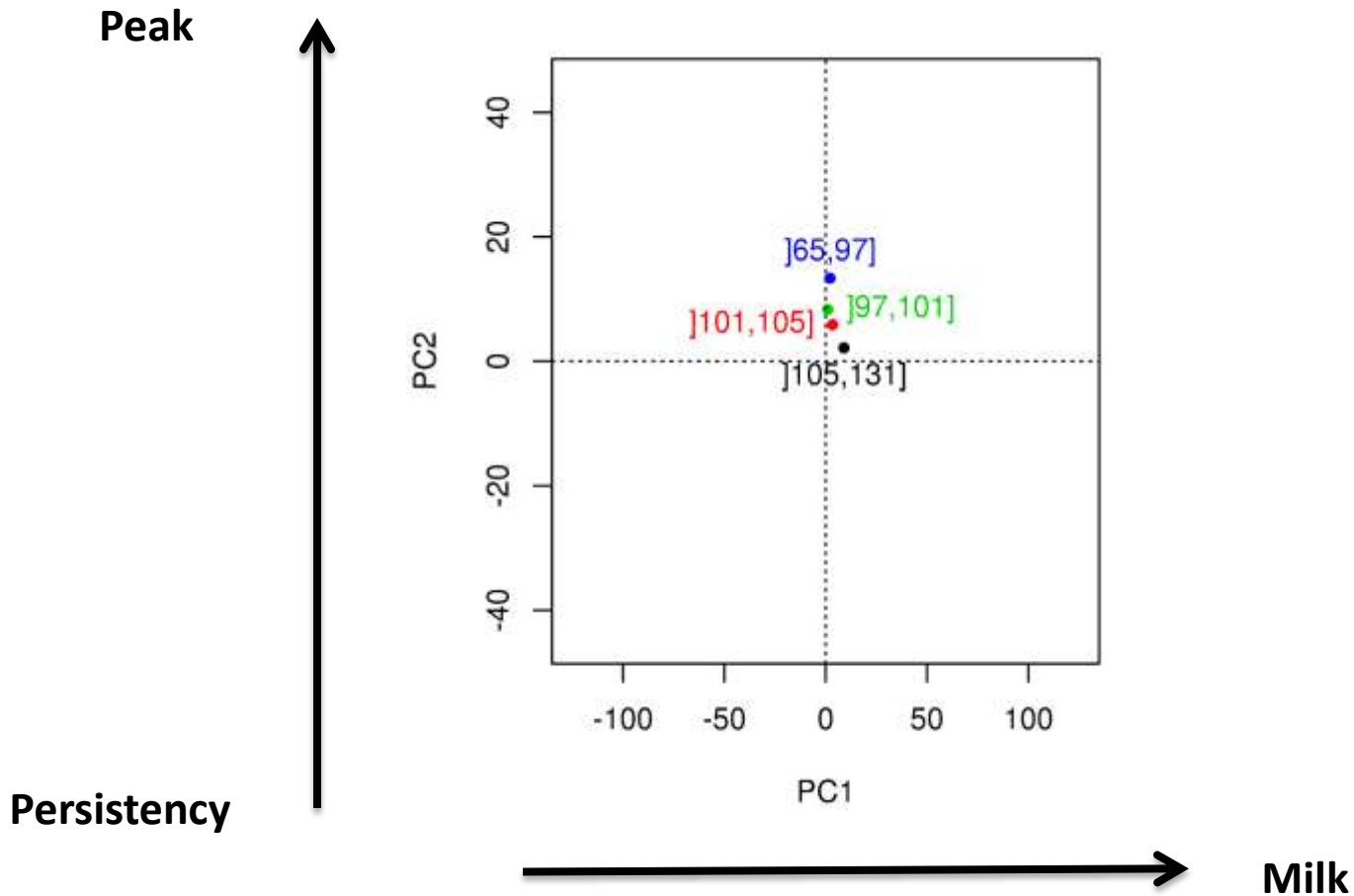
Parity is a factor related to the first two components:



Dry-period length (days)

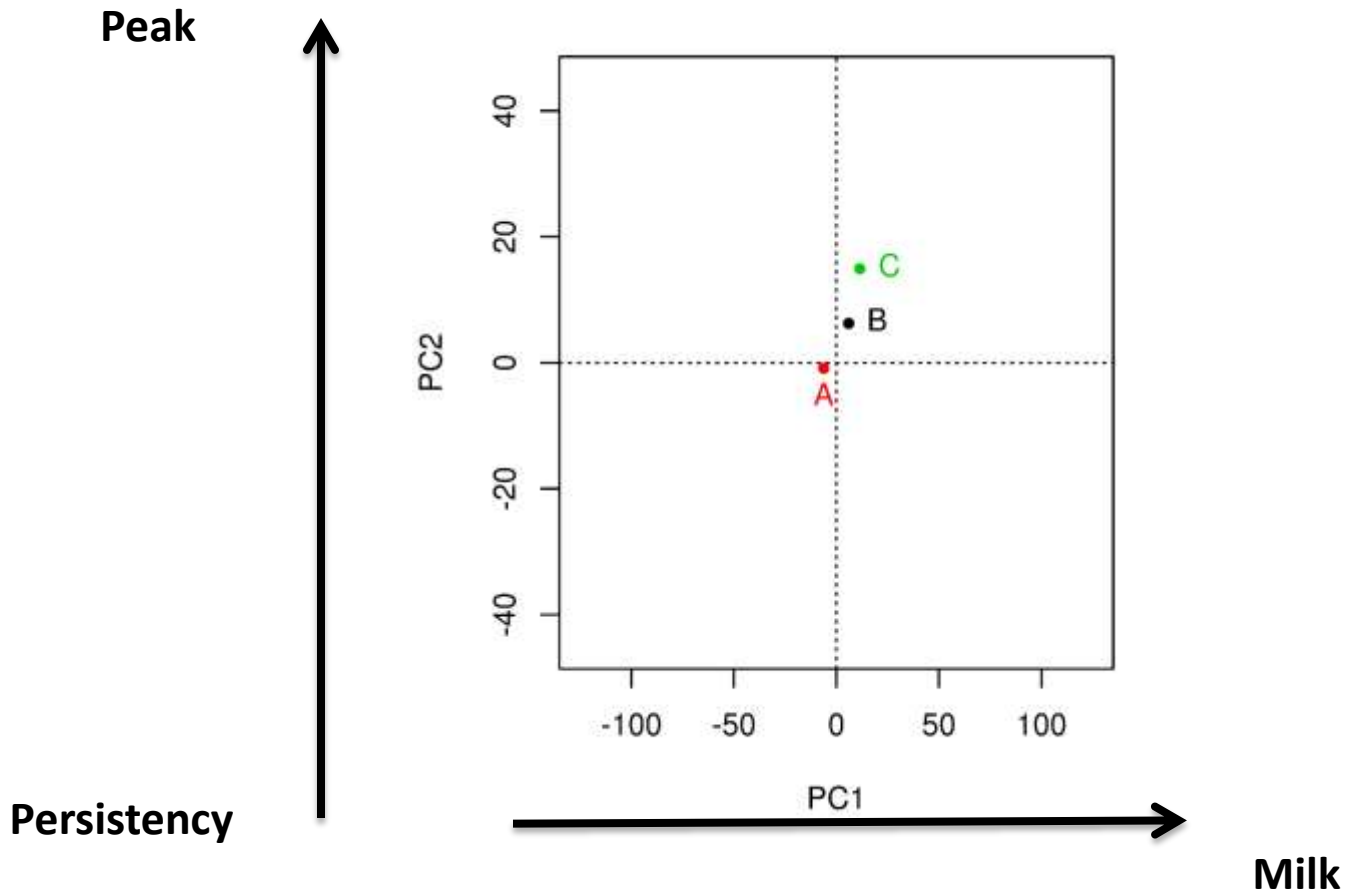


Somatic cell score EBV



base 100 : <100: increase somatic cell count (SCC), >100: reduce SCC

Age at kidding



A=9-10 months at first kidding or 16-22 months at second kidding or 22-34 months at third kidding
B= 11-13 months at first kidding or 23-25 months at second kidding or 35-37 months at third kidding
C=14-30 months at first kidding or 26-56 months at second kidding or 38-77 months at third kidding

The herd effect is linked to the three main components

- Effect of “Herd number” on residues of general models

Variables	1 st component (Level)	2 nd component (Slope)	3 rd component (Maintain)
Milk genetic index	1		
Region	2	8	
Breed	3	2	
Lactation rang	6	4	
Gestation stage	4	3	2
Kidding month	4	1	1
Age at kidding	6	7	3
Dry period length		6	
Somatic cell index		5	

- Effect of the herd number on the residues important for the first main component (r^2 of 0.397, 0.178 and 0.162 for the 1st, 2nd and 3rd main component)

Others environmental factors related to the components

- **Gestation stage:** Goats with more advanced gestation are less persistent
- **Parity:** After each lactation the goats are less persistent but produce more until fourth lactation then the production decreases keeping the same shape.
- **SCS EBV:** Goats which have a better index are more persistent
- **Kidding age :** Goats which are younger at kidding produce less but they are more persistent
- **Dry-period length:** Goats which are dry during a short period are more persistent
- **Effect of the “herd” on the residues:** important for the first main component (r^2 of 0.397, 0.178 and 0.162 for the 1st, 2nd and 3rd main component)