Increasing resilience of small ruminants farming systems: 3 management strategies across countries

Julien Quenon, Vincent Thenard, Georgios Arsenos, Giovanni Bailo, Rebeca Baptista, Ignacio de Barbieri, Guido Bruni, Fernando Freire, Alexandros Theodoridis, Sotiria Vouraki

▶ **To cite this version:**

Julien Quenon, Vincent Thenard, Georgios Arsenos, Giovanni Bailo, Rebeca Baptista, et al.. Increasing resilience of small ruminants farming systems: 3 management strategies across countries. 73rd Annual Meeting of the European Federation of Animal Science, Sep 2022, Porto, Portugal. hal-03775168

HAL Id: hal-03775168
https://hal.inrae.fr/hal-03775168v1

Submitted on 20 Dec 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Increasing resilience of small ruminants farming systems: three management strategies across countries

Results of the WP 7.2 of the SMARTER project (SMAll RuminanTs breeding for Efficiency and Resilience)

J. Quénon [1], G. Arsenos [2], G. Bailo [3], R. Baptista [4], I. De Barbieri [4], G. Bruni [3], F. Freire [5], A. Theodoridis [2], S. Vouraki [2] and V. Thénard [1]

[1] Université de Toulouse, INPT, INP-PURPAN, INRAE, AGIR, 31320 Castanet-Tolosan, France

[2] School of Veterinary Medicine, Aristotle University, 54124 Thessaloniki, Greece

[3] ARAL, 26013 Crema, Italy

[4] INIA Tacuarembó, Route 5 km 386, 45000, Tacuarembó, Uruguay

[5] OVIGEN, Granja Florencia S/N, Ctra. Villalazán-Peleagonzalo, 49800 Zamora, Spain;gerencia@assafe.es

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Introduction

- Small ruminant livestock are of socio-economic and environmental importance to many rural communities around the world (FAO, 2009)

  ➡ **their sustainability is a crucial issue** (Joy et al., 2020; Leite et al., 2021)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Introduction

- Small ruminant livestock are of socio-economic and environmental importance to many rural communities around the world (FAO, 2009)

  ➡ **their sustainability is a crucial issue** (Joy et al., 2020; Leite et al., 2021)

- Choosing breeding goals adapted to such issue (Phocas et al., 2016), by selecting traits that enhance:

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Introduction

- Small ruminant livestock are of socio-economic and environmental importance to many rural communities around the world (FAO, 2009)

  ➡ **their sustainability is a crucial issue** (Joy et al., 2020; Leite et al., 2021)

- Choosing breeding goals adapted to such issue (Phocas et al., 2016), by selecting traits that enhance:
  - **Resilience/robustness** = buffer, adaptive and transformative capacity in a changing/uncertain context (Dumont et al., 2020)
    - Resistance to heat stress (Sejian et al., 2019; Sánchez-Molano et al., 2020)
    - Resistance to parasitism and diseases (Hine et al., 2022; Doeschl-Wilson et al., 2022)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Introduction

- Small ruminant livestock are of socio-economic and environmental importance to many rural communities around the world (FAO, 2009)

  ➡ **their sustainability is a crucial issue** (Joy et al., 2020; Leite et al., 2021)

- Choosing breeding goals adapted to such issue (Phocas et al., 2016), by selecting traits that enhance:
  - **Resilience/robustness** = buffer, adaptive and transformative capacity in a changing/uncertain context (Dumont et al., 2020)
    - Resistance to heat stress (Sejian et al., 2019; Sánchez-Molano et al., 2020)
    - Resistance to parasitism and diseases (Hine et al., 2022; Doeschl-Wilson et al., 2022)
  - **Efficiency** = production related to the use of the necessary resources
    - Feed intake (Amarilho-Silveira et al., 2022)
    - Land use (Hennessy et al., 2021)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Introduction

- SMARTER (SMAll RuminanTs breeding for Efficiency and Resilience) H2020 project aims to **redefine genetic selection criteria to increase the sustainability of the small ruminants sectors**
- Adjusting breeding objectives to small ruminants farmers' expectations, actual breeding practices and views on sustainability (Perucho et al., 2019; Kosgey et al., 2006)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Introduction

- SMARTER (SMAll RuminanTs breeding for Efficiency and Resilience) H2020 project aims to **redefine genetic selection criteria to increase the sustainability of the small ruminants sectors**
- Adjusting breeding objectives to small ruminants farmers' expectations, actual breeding practices and views on sustainability (Perucho et al., 2019; Kosgey et al., 2006)

Smarter
SMAll RuminanTs breeding for Efficiency and Resilience

What criteria (genetic or not) do farmers/breeders use?

Which traits do they think are relevant to increase the sustainability of their farm?

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

Milk
Meat
Wool

1. DATA COLLECTION

Sampling

France

Lacaune
Manech tête rousse

Causse du Lot
Romane

Greece

Assaf
Chios
Frizarta
Lacaune

Boutsko

Skopelos

Italy

Alpine
Saanen

Spain

Assaf

Uruguay

Corriedale
Merino

15
Breed × System

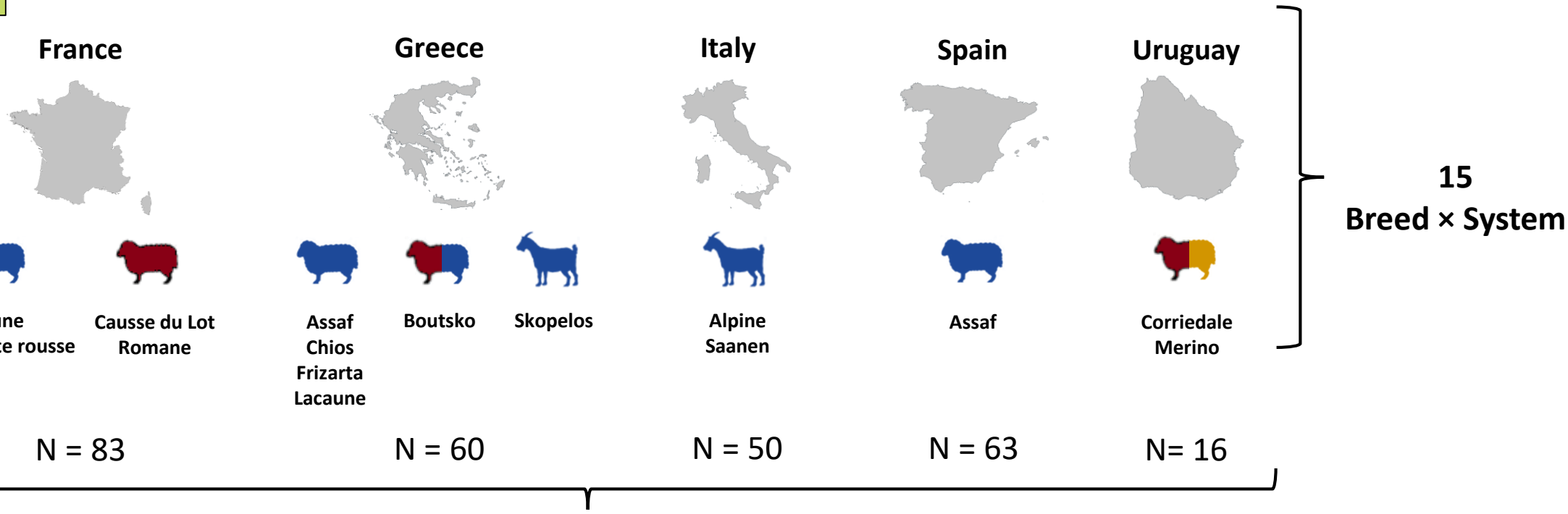
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

Milk
Meat
Wool

1. DATA COLLECTION

Sampling



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION

Sampling	Semi-structured interviews

I. **Crops management:** rotation, fertilisation and crop protection practices, etc.

N = 272

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION

Sampling	Semi-structured interviews

I. **Crops management:** rotation, fertilisation and crop protection practices, etc.

II. **Flock management:** size, breeds, reproduction and culling practices, etc.

N = 272

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION

Sampling	Semi-structured interviews

N = 272

I. **Crops management:** rotation, fertilisation and crop protection practices, etc.

II. **Flock management:** size, breeds, reproduction and culling practices, etc.

III. **Genetic management practices:**

- Knowledge and use of EBVs/selection indexes
- Criteria and traits used to select breeding animals
- Sustainability-related traits to select on in the future

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION

Sampling	Semi-structured interviews

N = 272

I. **Crops management:** rotation, fertilisation and crop protection practices, etc.

II. **Flock management:** size, breeds, reproduction and culling practices, etc.

III. **Genetic management practices:**
- Knowledge and use of EBVs/selection indexes
- Criteria and traits used to select breeding animals
- Sustainability-related traits to select on in the future

IV. Socio-technical information:
- Involvement in the breeding/performance recording organisations
- Opinions on genomics/crossbreeding
- Opinions on information share between countries and organisations

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION | **2. DATA EDITING**

- Qualitative data:

  Building categorical variables = data abstraction (Girard et al., 2008) :

  "*From a abundant diversity of responses to an acceptable one*"

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION **2. DATA EDITING**

- Qualitative data:

  Building categorical variables = data abstraction (Girard et al., 2008) :

  "*From a abundant diversity of responses to an acceptable one*"

- Quantitative data:

  Calculation of relative indicators e.g. % of artificial insemination used

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION
2. DATA EDITING
3. MULTIVARIATE ANALYSIS

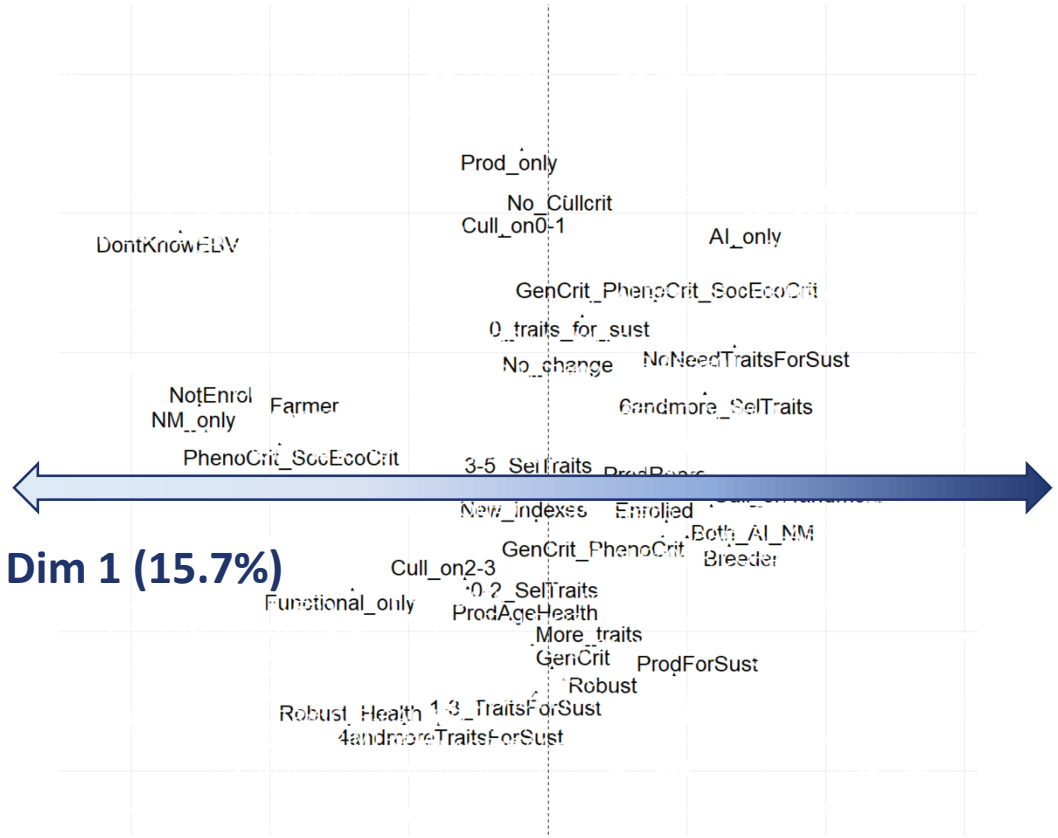
- **Factorial analysis of mixed data (FAMD)**: analysing pattern of relationships described by both quantitative and categorical data

- **Hierarchical clustering**: discriminating and characterising groups of small ruminants' farmers with contrasted breeding practices

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Results

Axis 1 determined by the **level of integration of small ruminants' farmers in the sociotechnical system of breed selection and performance recording**

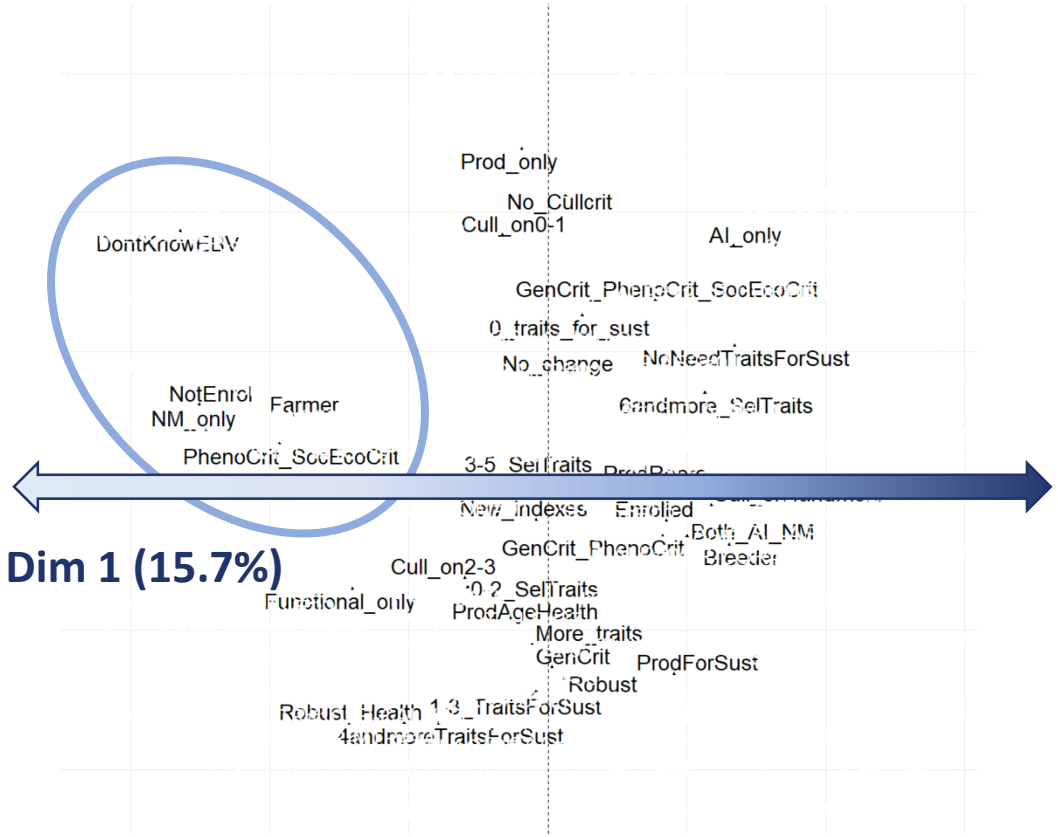


This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Results

Axis 1 determined by the **level of integration of small ruminants' farmers in the sociotechnical system of breed selection and performance recording**

- Farmers
- Don't know EBVs
- Not enrolled in performance controlling organisations
- Using natural mating only
- Don't use genetic criteria to buy breeding animals



Low level of integration in the sociotechnical system of breed selection and performance recording organisations

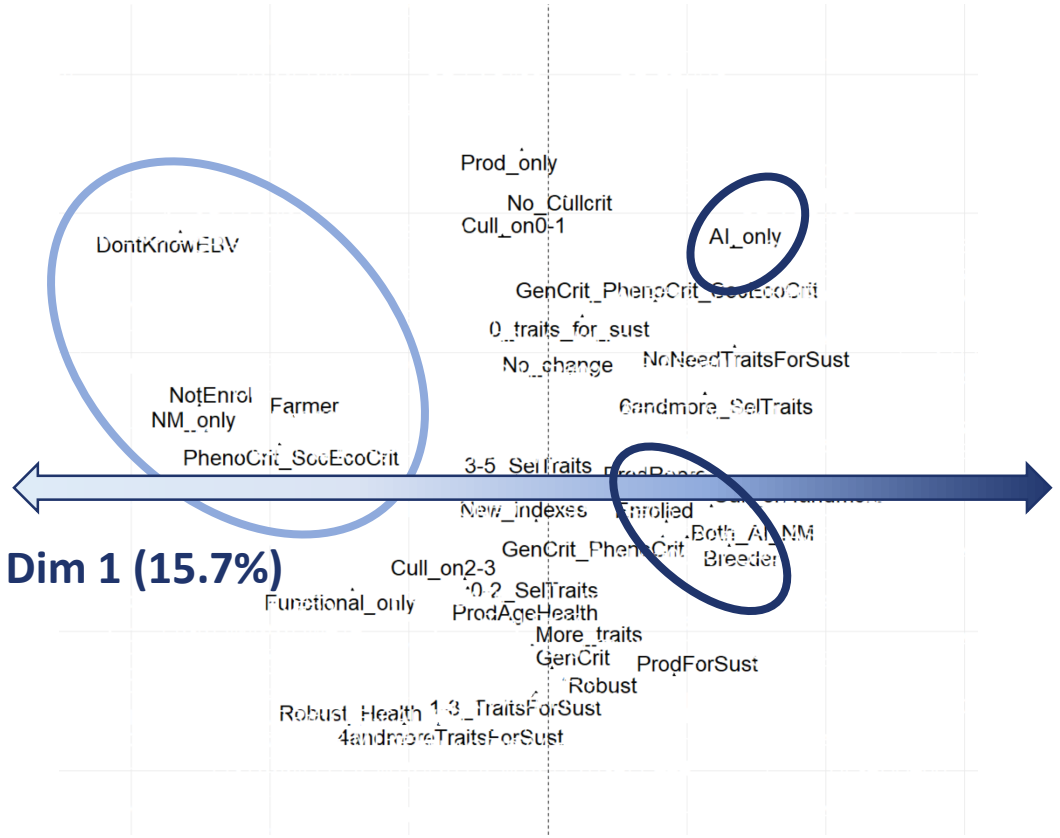
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Results

Axis 1 determined by the **level of integration of small ruminants' farmers in the sociotechnical system of breed selection and performance recording**

- Farmers
- Don't know EBVs
- Not enrolled in performance controlling organisations
- Using natural mating only
- Don't use genetic criteria to buy breeding animals

Low level of integration in the sociotechnical system of breed selection and performance recording organisations



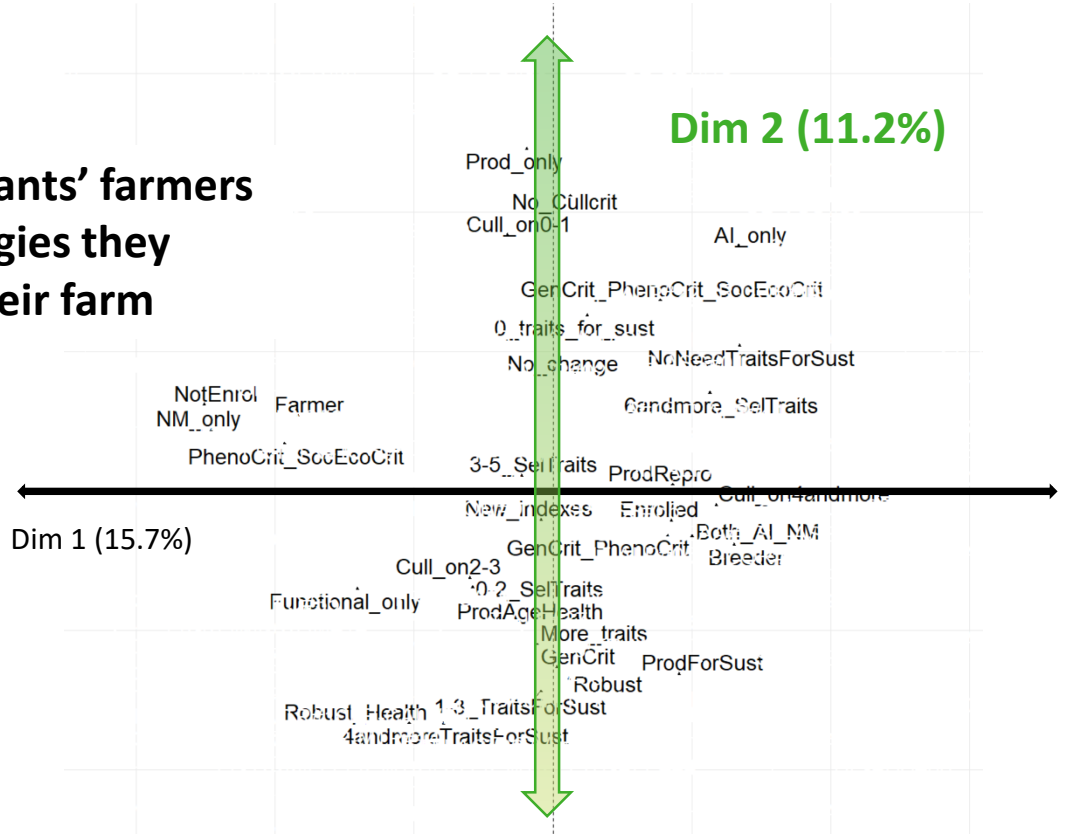
- Breeders
- Enrolled in performance controlling organisations
- Using artificial insemination only

High level of integration in the sociotechnical system of breed selection and performance recording organisations

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Results

Axis 2 determined by the **small ruminants' farmers views on sustainability and the strategies they intended to adopt to increase it on their farm**



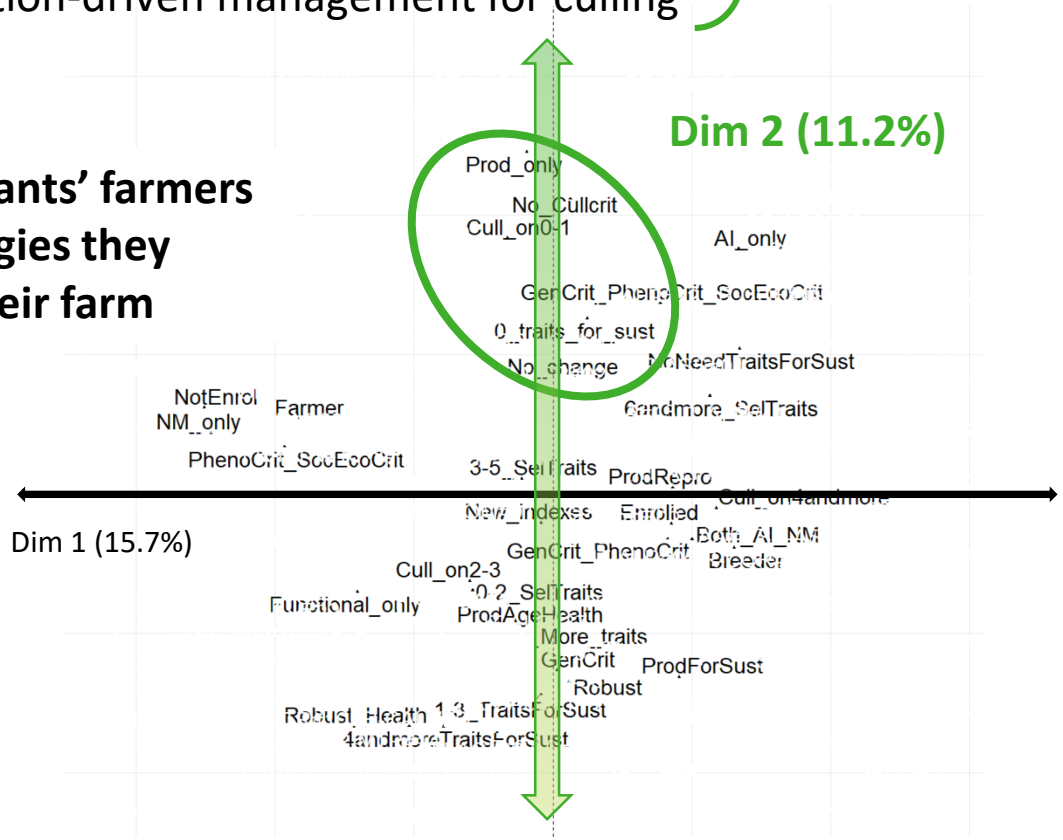
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Results

- No need new traits for sustainability
- Sustainability is no relevant objective
- Satisfied with the current indexes
- Production-driven management for culling

Little interest in adding new traits in the selection indexes nor in increasing the sustainability of their farming system

Axis 2 determined by the **small ruminants' farmers views on sustainability and the strategies they intended to adopt to increase it on their farm**



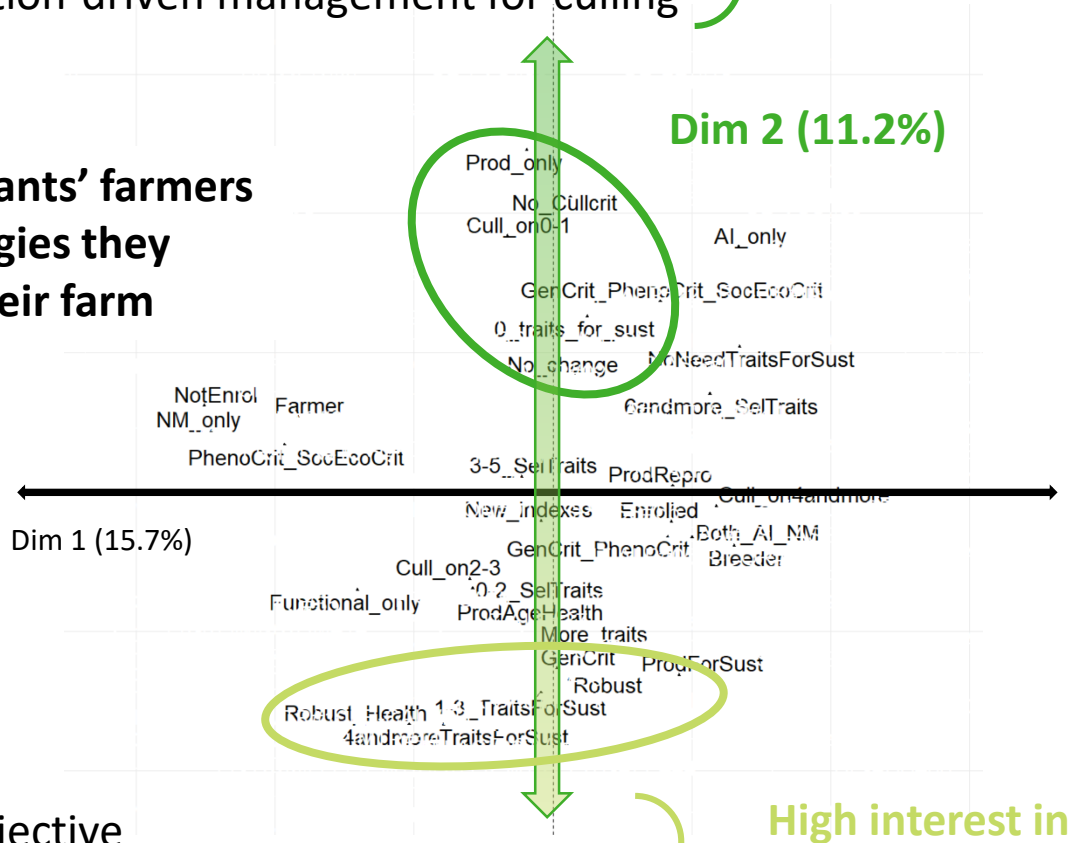
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Results

- No need new traits for sustainability
- Sustainability is no relevant objective
- Satisfied with the current indexes
- Production-driven management for culling

Little interest in adding new traits in the selection indexes nor in increasing the sustainability of their farming system

Axis 2 determined by the **small ruminants' farmers views on sustainability and the strategies they intended to adopt to increase it on their farm**



- Sustainability is a crucial objective
- Unsatisfied with the current indexes
- Ask for robustness- and health-related traits in the indexes

High interest in adding robustness-related traits in the current selection indexes to increase sustainability of their farming system

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

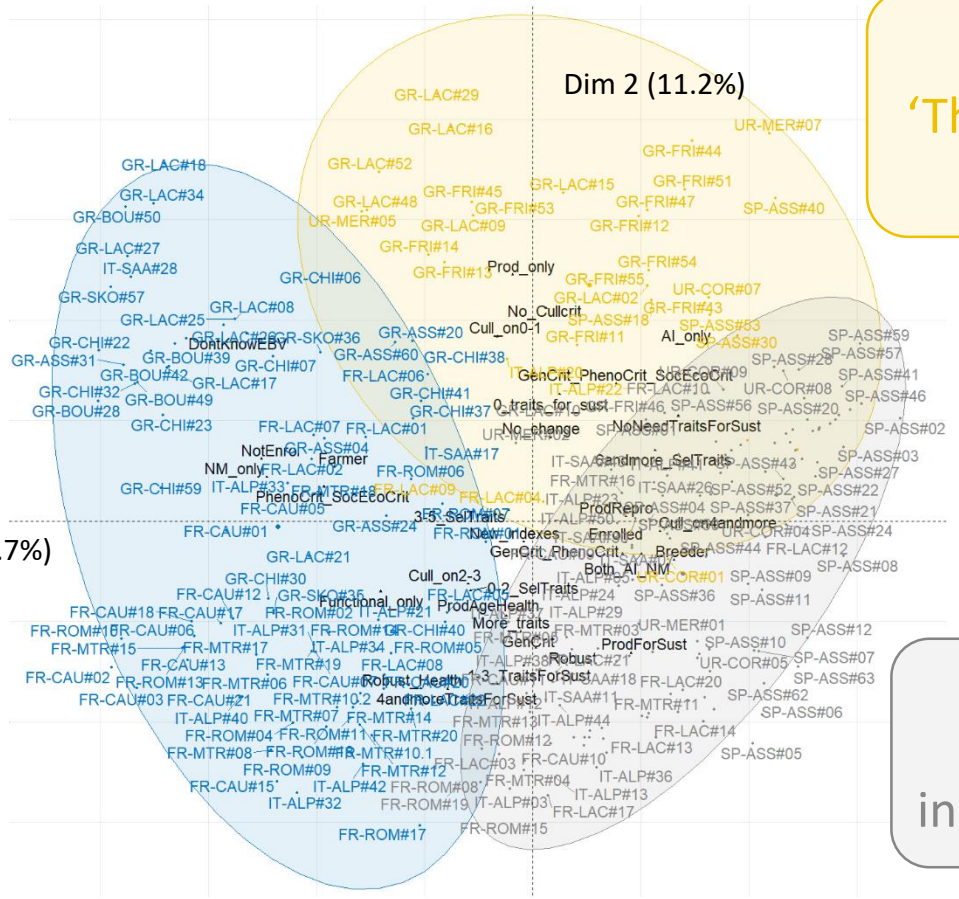
Results

Little interest in adding robustness traits in the indexes to increase sustainability

Group 1 (n = 93)
'The non-geneticists aiming at robustness and multifunctionality'

Group 2 (n = 34)
'The farmers aiming at increasing production efficiency'

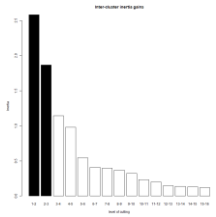
Low level of integration in the sociotechnical system



High level of integration in the sociotechnical system

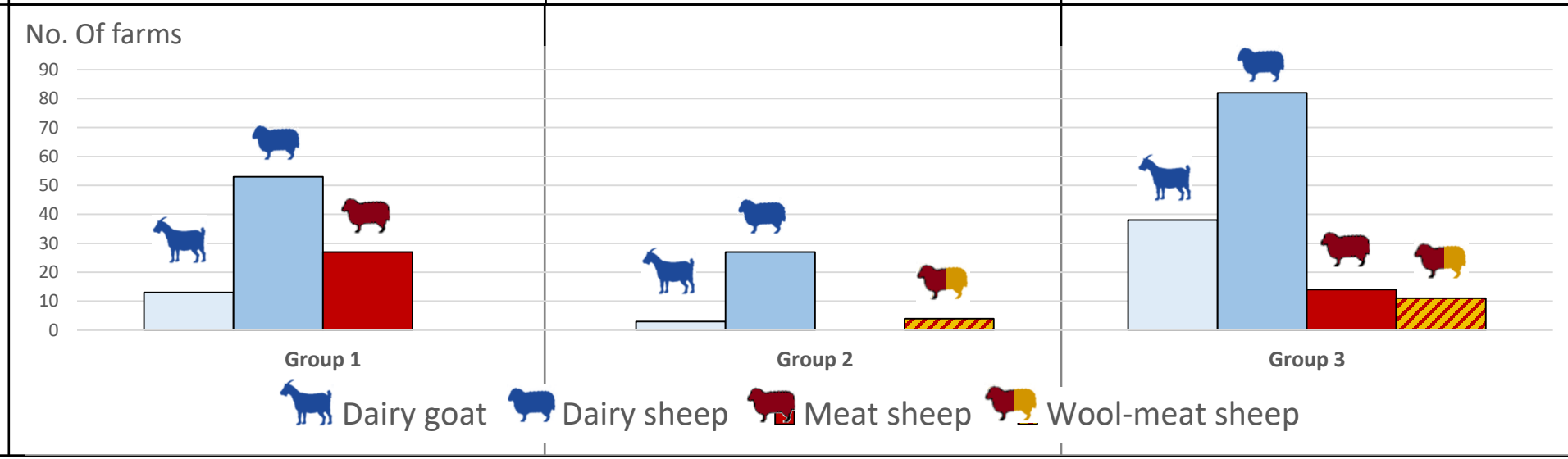
Group 3 (n = 145)
'The geneticists aiming at increasing production efficiency'

High interest in adding robustness traits in the indexes to increase sustainability



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

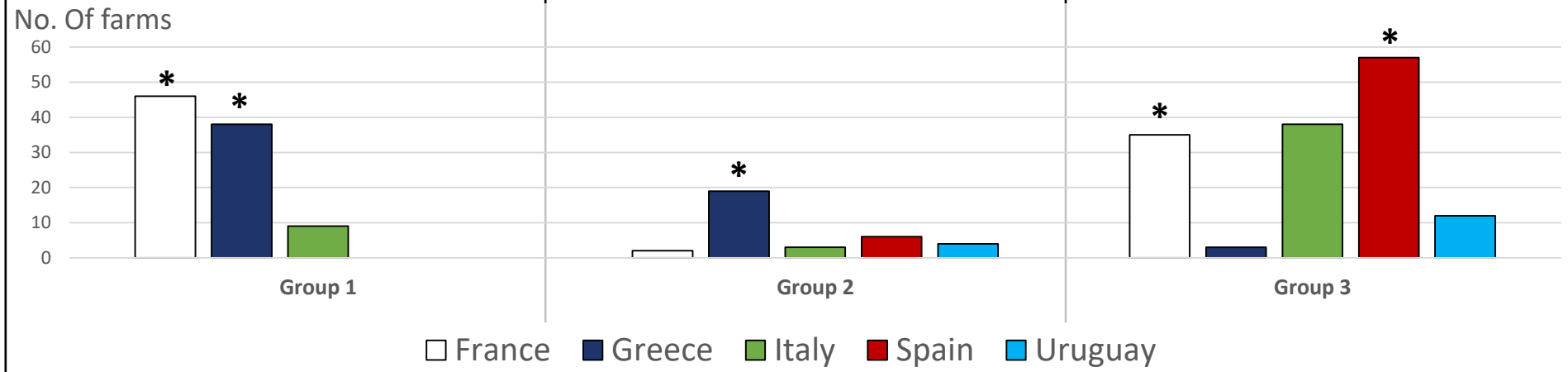
Discussion

	Group 1 (n = 93) 'The non-geneticists aiming at robustness and multifunctionality'	**Group 2 (n = 34)** 'The farmers aiming at increasing production efficiency'	**Group 3 (n = 145)** 'The geneticists aiming at increasing production efficiency'
Livestock farming system			

➡ No overlap between groups and livestock systems: **breeding management strategies** and **views on sustainability do not seem to depend on livestock species/farming system**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Discussion

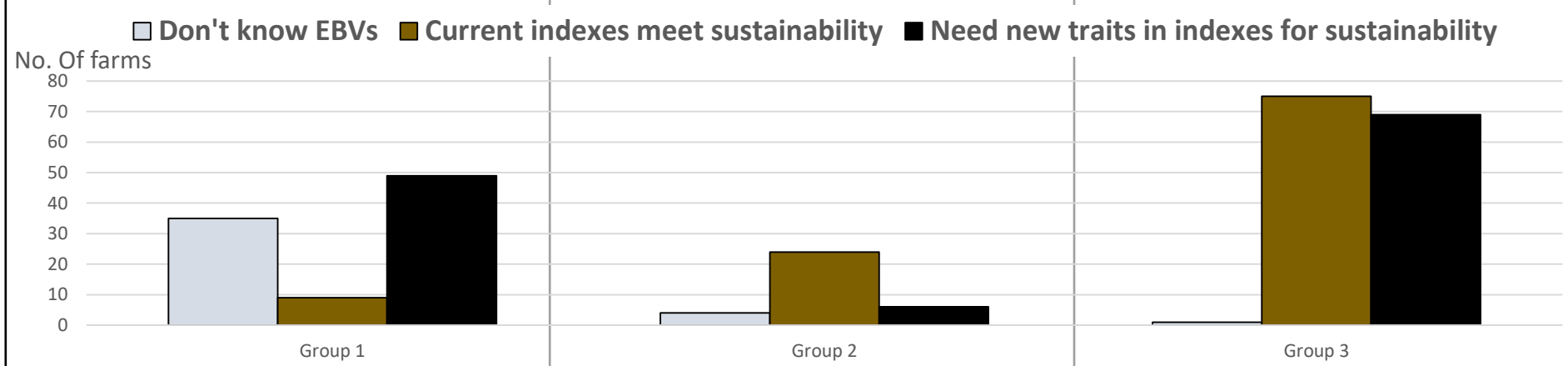
	Group 1 (n = 93) 'The non-geneticists aiming at robustness and multifunctionality'	**Group 2 (n = 34)** 'The farmers aiming at increasing production efficiency'	**Group 3 (n = 145)** 'The geneticists aiming at increasing production efficiency'
Country			

➡ Overlap between groups and countries: **socio-technical elements could explain the differences between the groups**

- **Level of structuring** of the breeding selection system
- **Level of dissemination** of technologies and knowledge on genetics (e.g. AI, indexes, genomics)
- **Shared knowledge among farmers** on specific topics (e.g. sustainability/robustness/resilience)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Discussion

	Group 1 (n = 93) 'The non-geneticists aiming at robustness and multifunctionality'	**Group 2 (n = 34)** 'The farmers aiming at increasing production efficiency'	**Group 3 (n = 145)** 'The geneticists aiming at increasing production efficiency'
Views on sustainability			

- **Interest in the issue of sustainability** varied among farmers
- **Confidence in genetic tools and their relevance** to increasing resilience varied among farmers

➡ to what extent SMARTER objectives fit farmers' expectations (vs. breeders')?

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Acknowledgments

Rebeca Baptista

Ignacio de Barbieri

Guido Bruni

Giovanni Bailo

Sotiria Vouraki

Alexandros Theodoridis

Georgios Arsenos

Fernando Freire

Juben Jimenez

Vincent Thénard

Nina Usai

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Thank you for your attention

Any questions?

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION | **2. DATA EDITING**

- Qualitative data:

  Building categorical variables = data abstraction (Girard et al., 2008) :

  "*From a abundant diversity of responses to an acceptable one*"

On which traits do you think animals should be selected to increase sustainability of your farming system?

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

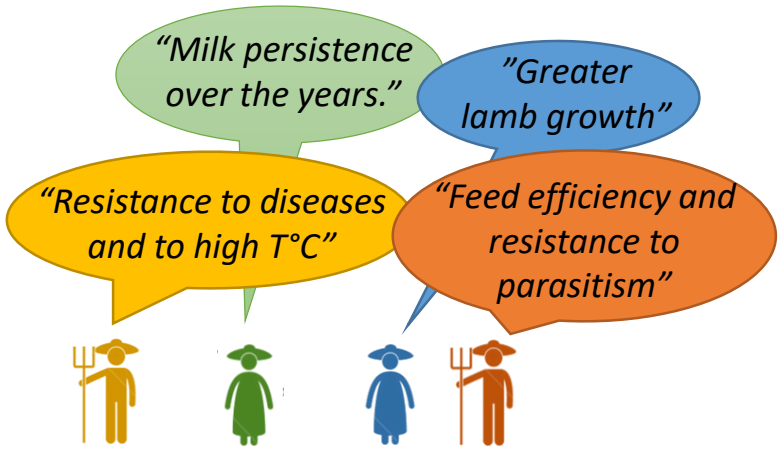
1. DATA COLLECTION | **2. DATA EDITING**

- Qualitative data:

  Building categorical variables = data abstraction (Girard et al., 2008) :

  "*From a abundant diversity of responses to an acceptable one*"

On which traits do you think animals should be selected to increase sustainability of your farming system?



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

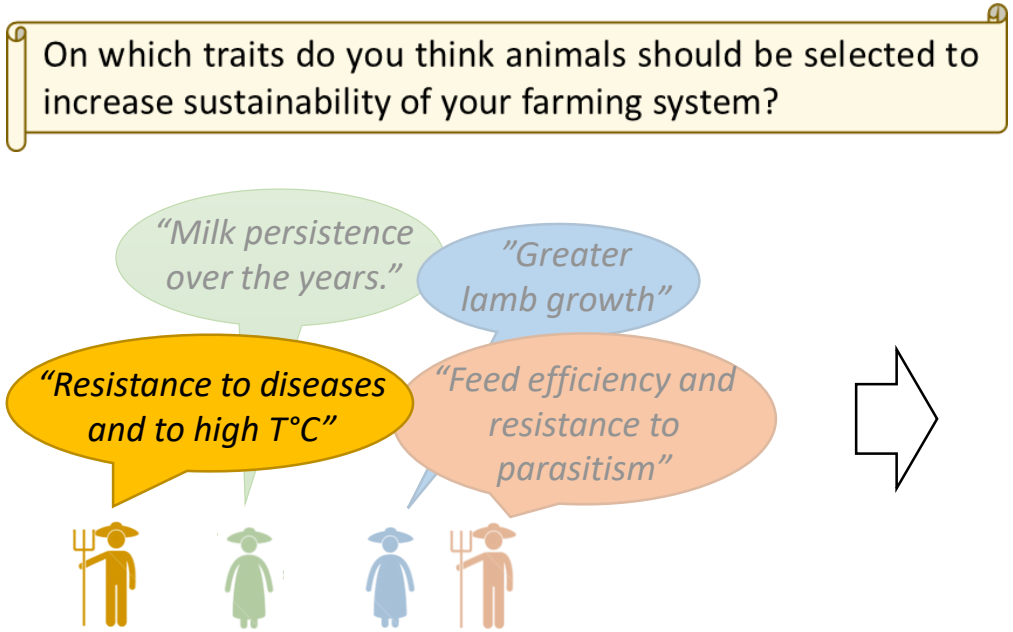
Material and methods

1. DATA COLLECTION → **2. DATA EDITING**

- Qualitative data:

  Building categorical variables = data abstraction (Girard et al., 2008) :

  "From a abundant diversity of responses to an acceptable one"



#	Livestock system	Production trait	Resilience trait	Efficiency trait
	Meat-wool sheep	No	Yes	Yes

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

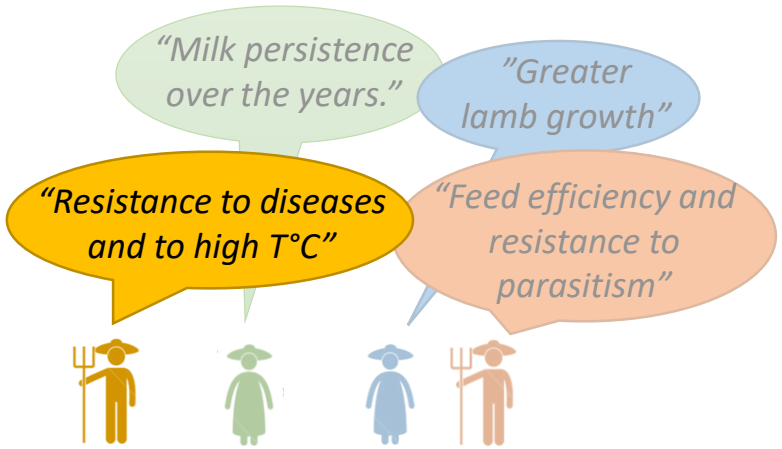
1. DATA COLLECTION → **2. DATA EDITING**

- Qualitative data:

  Building categorical variables = data abstraction (Girard et al., 2008) :

  "*From a abundant diversity of responses to an acceptable one*"

On which traits do you think animals should be selected to increase sustainability of your farming system?



#	Livestock system	Production trait	Robustness trait	Health trait
	Meat-wool sheep	No	Yes	Yes

Traits needed for sustainability
Robust_Health

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

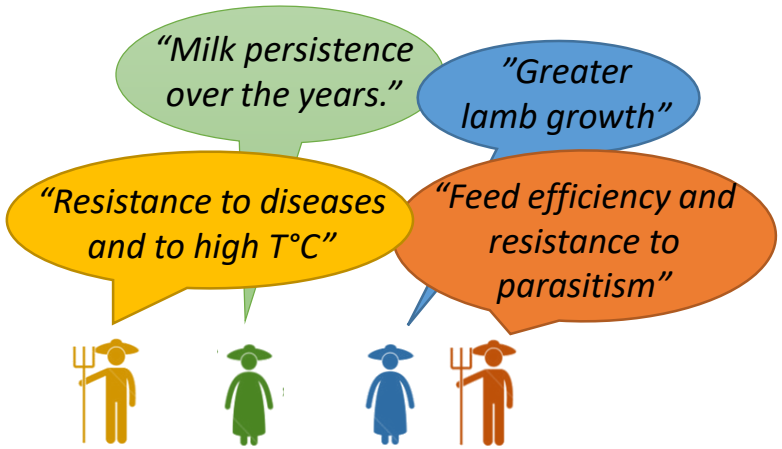
1. DATA COLLECTION | **2. DATA EDITING**

- Qualitative data:

  Building categorical variables = data abstraction (Girard et al., 2008) :

  "From a abundant diversity of responses to an acceptable one"

On which traits do you think animals should be selected to increase sustainability of your farming system?



#	Livestock system	Production trait	Robustness trait	Health trait
	Meat-wool sheep	No	Yes	Yes
	Dairy goat	Yes	No	No
	Meat sheep	Yes	No	No
	Dairy sheep	No	Yes	Yes

Traits needed for sustainability
Robust_Health
Production
Production
Robust_Health

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION → **2. DATA EDITING**

- Qualitative data:

  Building categorical variables = data abstraction (Girard et al., 2008) :

  "*From a abundant diversity of responses to an acceptable one*"

On which traits do you think animals should be selected to increase sustainability of your farming system?

#	Livestock system	Production trait	Robustness trait	Health trait
	Meat-wool sheep	No	Yes	Yes
	Dairy goat	Yes	No	No
	Meat sheep	Yes	No	No
	Dairy sheep	No	Yes	Yes

From **4 initial unique responses** to **2 classes**

Traits needed for sustainability
Robust_Health
Production
Production
Robust_Health

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION **2. DATA EDITING**

- Final dataset: 272 individuals described by 12 active (+ 29 supplementary) variables

I. Crops management: Ø

II. Flock management:
  - **V1 – Replacement rate** (%)
  - **V2 – Percentage of artificial insemination used in the flock** (%)
  - **V3 – Use of AI:** *Only natural mating / Only artificial insemination / Both AI and NM*

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION | **2. DATA EDITING**

- Final dataset: 272 individuals described by 12 active (+ 29 supplementary) variables

III. Genetic management practices:

- **V4 – No. of culling criteria**: *0 to 1 / 2 to 3 / 4 and more*
- **V5 – Culling criteria**: *No culling criteria / Production only / Functional traits only / Production & Reproduction / Production, Health & Age*
- **V6 – Type of criteria used to select animals**: *No genetic criteria / Genetic only / Genetic & Phenotypic / Genetic, Phenotypic & Socio-economic*
- **V7 – No. of selection traits used**: *0 to 2 / 3 to 5 / 6 and more*
- **V8 – No. of traits to ↗ sustainability**: *0 / 1 to 3 / 4 and more*
- **V9 – New traits to ↗ sustainability**: *No answer / No need / Production / Robustness / Robustness & Health*

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION **2. DATA EDITING**

- Final dataset: 272 individuals described by 12 active (+ 29 supplementary) variables

IV. Socio-technical information

- **V10 – Change to make in selection indexes**: *No change / More traits / New indexes with different weighting*
- **V11 – Breeder status:** *Farmer using genetic progress / Breeder*
- **V12 – Enrollment in performance recording organisations:** *Enrolled / Not enrolled*

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION → **2. DATA EDITING**

Itw section	Name of the variable	Definition	Type of variable	Use of the variable in the FAMD	Details
1.CROPS	UAA	Utilized Agricultural Area (ha)	Quantitative	Supplementary	
1.CROPS	PercMeadGrass	% of meadows + grassland in UAA	Quantitative	Supplementary	
1.CROPS	FertiPractices	Fertilization practices	Categorical	Supplementary	Mineral/Organic/Both/None
1.CROPS	PercSurfPesti	% of UAA on which pesticides are used	Quantitative	Supplementary	
2.LIVESTOCK	UGBSmallRum	Flock size (UGB)	Quantitative	Supplementary	

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION **2. DATA EDITING**

Itw section	Name of the variable	Definition	Type of variable	Use of the variable in the FAMD	Details
2.LIVESTOCK	Replacement	Replacement rate	Quantitative	Active	
2.LIVESTOCK	PercOfAI	% of the flock on which AI is used	Quantitative	Active	
2.LIVESTOCK	UseOfAI	Use of AI or natural mating	Categorical	Active	AI only / NM only / Both
2.LIVESTOCK	BreederStatus	Status of the farmer	Categorical	Active	Breeder/Farmer
2.LIVESTOCK	PerfControl	Enrollment in performance recording organisation	Categorical	Active	Enrolled/ NotEnrol
2.LIVESTOCK	NbCullCrit	No. Of culling criteria used	Quantitative	Active	

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION → **2. DATA EDITING**

Itw section	Name of the variable	Definition	Type of variable	Use of the variable in the FAMD	Details
3.TRAITS & INDEXES	CritForSelec	Criteria to select reproductive animals	Categorical	Active	Genetical/Phenotype/Other
3.TRAITS & INDEXES	NbSelTraits	Number of traits used to select	Quantitative	Active	**Med = 4**; Min = 0; Max = 10
3.TRAITS & INDEXES	NbTraitsForSust	Number of traits cited as potentially increasing the resilience of the farm	Quantitative	Active	**Med = 0**; Min = 0; Max = 8
3.TRAITS & INDEXES	TraitsForSust	Traits cited as increasing the resilience of the farm	Categorical	Active	Ø / Production / Robustness / Don't know EBV
3.TRAITS & INDEXES	ChangeIndex	Would the farmer like a new index?	Categorical	Active	More traits / New indexes / No change
3.TRAITS & INDEXES	BuyMales	Does the farmer buy males?	Categorical	Active	No / Yes with/without EBV

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Material and methods

1. DATA COLLECTION → **2. DATA EDITING**

Itw section	Name of the variable	Definition	Type of variable	Use of the variable in the FAMD	Details
4. BREEDING ORGANISATION	LimGenProgress	What limits genetical progress?	Categorical	Supplementary	Nothing / Organisation / Data / Indivdual / …
4. BREEDING ORGANISATION	GenomicsDev	How do you consider genomics development?	Categorical	Supplementary	Want to be in / Not a priority
4. BREEDING ORGANISATION	Crossbreeding	Do you use crossbreeding?	Categorical	Supplementary	Yes / No

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Results

Group 1 (n = 93): 'The non-geneticists aiming at robustness and multifunctionality'

- Not enrolled in performance recording org.
- Less knowledge of genetics
- Less use of the tools of genetic progress (e.g. indexes, AI).
- Selection of animals on non-genetic traits and culled on functional traits.
- Mostly French and Greek meat sheep farmers
- Smaller flocks
- Multiple-breeds flocks
- Lower replacement rate
- Higher % of meadows and grassland in UAA.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Results

Group 2 (n = 34): 'The farmers aiming at increasing production efficiency'

- Production-driven flock management
- Mostly Greek dairy sheep farmers
- Low % of meadows/grassland in the UAA
- Low use of pesticides
- Selecting on production traits to increase sustainability of their farming system.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Results

Group 3 (n = 145): 'The geneticists aiming at increasing production efficiency'

- Mostly Spain and Italian breeders + Uruguayan farmers
- Large flocks
- Low % of meadows/grassland
- High use of pesticides
- Demanding flock configuration practices:
  - higher use of artificial insemination
  - higher replacement rate
- Strong knowledge in genetics
- Enrolled in performance control recording organisations
- Satisfied with the current indexes to ensure the sustainability of their system

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Results

	Group 1 (n = 93) 'The non-geneticists aiming at robustness and multifunctionality'	**Group 2 (n = 34)** 'The farmers aiming at increasing production efficiency'	**Group 3 (n = 145)** 'The geneticists aiming at increasing production efficiency'
Flock size *(LSU)*	47^{a}	51^{a}	96^{b}
Grassland in UAA *(%)*	0.59^{a}	0.28^{b}	0.36^{b}
Use of pesticides *(% of UAA)*	0.59^{a}	0.09^{b}	0.30^{c}
% of AI used *(%)*	0.06^{a}	0.62^{b}	0.58^{b}
Replacement rate *(%)*	0.23^{a}	0.09^{b}	0.36^{c}
No. of breeds in the flock	1.4^{a}	1.1^{b}	1.1^{b}

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 772787

Discussion

« What 'geneticists' dont understand is that genetic progress will be difficult to maintain as it is because. ***climate change will force farmers to adapt rather than rely on animal adaptation or selection alone****»*

« ***Too much emphasis is placed on the ram's paper****, on his genetic potential, and the breeders themselves place too much emphasis on this. »*