Smarter

SMAll RuminanTs breeding for Efficiency and Resilience

Selection tools to benefit from international cooperation in small ruminants: a comprehensive work package of the SMARTER project

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INSTITUT DE L'ELEVAGE idele

ICAR

ICAR 2021 26–30 APRIL THE NETHERLANDS LEEUWARDEN

INTERBULL

ICAR 2021: Leeuwarden, the Netherlands,
Virtual session, 29 April 2021

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement n°772787

SMARTER = SMAll RuminanTs breeding for Efficiency and Resilience

2018 – 2022 (2023)
Coordination: INRAE Toulouse
Partnership includes ICAR

WP6 "Practical Selection Tools to Benefit from International Cooperation"

Objective: contribute to faster genetic progress for resilience and efficiency traits in sheep and goats through improved international cooperation

HARMONISATION: phenotypes, genotypes, pedigree

INTERNATIONAL EVALUATION: genetic, genomic

PRACTICALITIES of international evaluations

ASSESS BENEFIT: modelled benefit of harmonization of phenotyping & int'l evaluation on long-term genetic gain

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Harmonisation

Description of **breeding programs and evaluation systems** in partners

Sharing agreements for pooling data

File format for exchanging phenotypes, genotypes, pedigree

research on **allele frequency** across country x breeds

Listed **novel traits** and their definition

Codification of **breeds**

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Harmonisation

File format for pedigree, phenotypes, genotypes, parameters, EBVs

Structure of PEDIGREE File exchanged in SMARTER

1. **Name= pedigree_*species_production_country_version_date*.txt**

N°	Data	Type & length	Comment	Example
1	International ID animal	(1)	Interbull format	Please see below
2	International ID sire	(1)	Interbull format	
3	International ID dam	(1)	Interbull format	
4	Birth date	YYYYMMDD		20120425
5	Year of birth	YYYY	Useless if birth date known	2012
6	Name of animal	Free		
7	Country sending data	(2)		FRA
8	National ID animal	Free the		
9	Animal_ID_alias1			
10	Animal_ID_alias2			
11	Animal_ID_alias3			
12	National ID sire	Free the		
13	Sire_ID_alias1			
14	Sire_ID_alias2			
15	Sire_ID_alias3			
16	National ID dam	Free the		
17	Dam_ID_alias1			
18	Dam_ID_alias2			
19	Dam_ID_alias3			

Structure of PHENOTYPE File exchanged in SMARTER

1. **Name= phenotype_*species_production_country_version_date*.txt**

N°	Data	Type & length	Comment	Example
1	Trait	(1)		MYI
2	Breed of evaluation	(2)		MTR
3	Country sending data	(3)		FRA
4	International animal ID	(4)	Interbull format	
5	Herd/flock	Free (as it is in the country)	Official ID in the country of origin	FR64124012
6	Dependent variable	Free		345
7	Statistical weight of the performance	(5) 0 to 1		1
8	Number (n) of environmental effects included in the national model			4
9	Environmental effects recoded (n times)	(6) Free		

Structure of GENOTYPE File exchanged in SMARTER

Name=genotype_*species_production_country_version_date*.txt

N°	Data	Type & length	Comment	Example
1	International animal ID	(1)	Interbull format	
2	SNP name	International name		OAR1_110509088.1
3	Allele A/B	Char,2		AB,--

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Harmonisation

Survey on programs and genetic/genomic evaluation

Session 61. **SMARTER: small ruminants breeding for efficiency and resilience**

Chair: Conington / Moreno

Theatre Session 61	Book of Abstracts page

9:15 Genetic evaluation systems and breeding programs in sheep and goats: an international perspective
L.F. Brito, D. Berry, H. Larroque, F.S. Schenkel, G. Ciappesoni, A. O'Brien, F. Tortereau, E. Ugarte, I. Palhiere, B. Bapst, J. Jakobsen, G. Antonakos, A. Kominakis, V. Clement, G. Bruni, V. Loywyck, E. Massender, H.R. Oliveira, J. Posta and J.M. Astruc

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Harmonisation

Exchanged genomic data and completed research on allele frequency across country x breeds

Session 61. **SMARTER: small ruminants breeding for efficiency and resilience**

Chair: Conington / Moreno

Theatre Session 61	Book of Abstracts page

61.18 Comparison of sheep genotype metrics across breeds and countries
A.C. O'Brien, J.M. Astruc, A. Tolkamp and D.P. Berry

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement n°772787

Harmonisation

Thermo SCIENTIFIC

illumina®

606,000
52,000 V1
52,000 V2
15,000
54,000
15,000

Identify informative SNPs across multiple types, breeds, and countries

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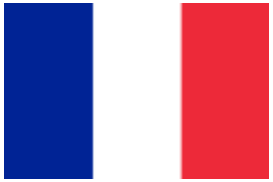
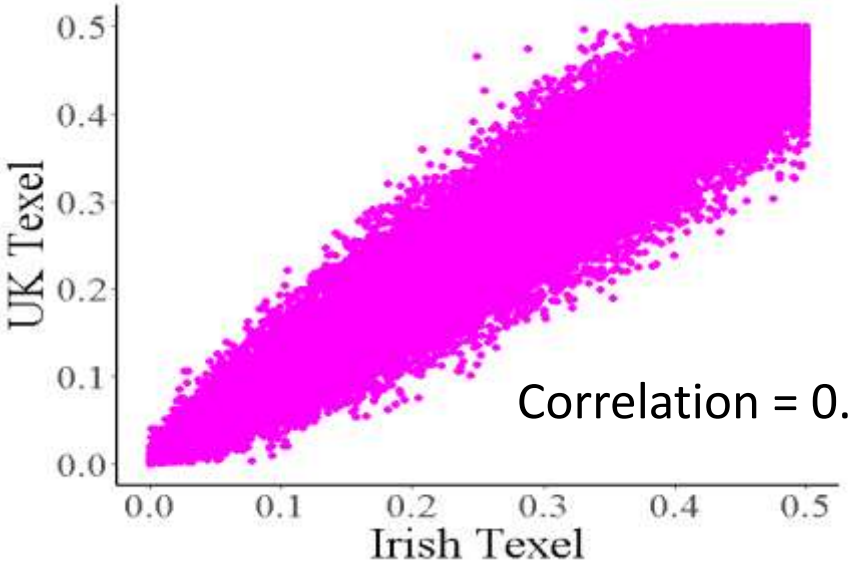
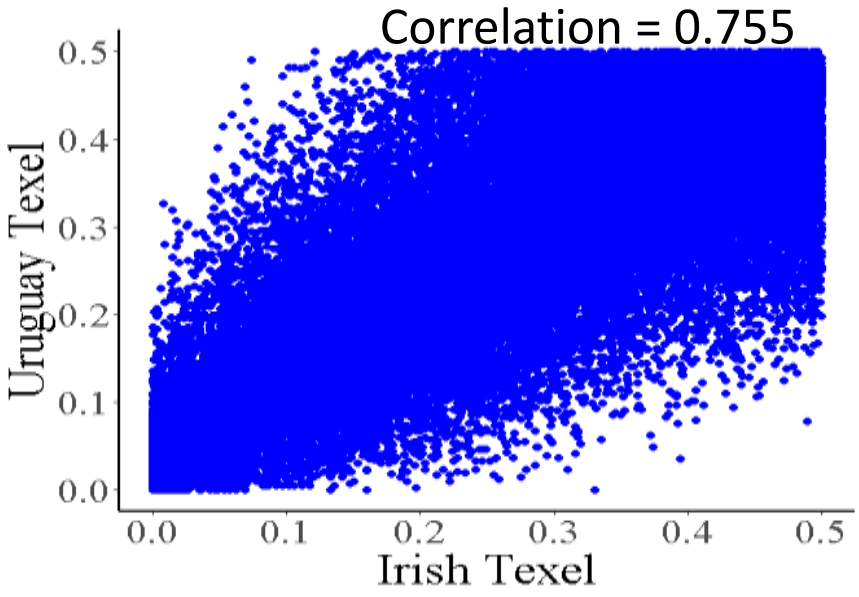
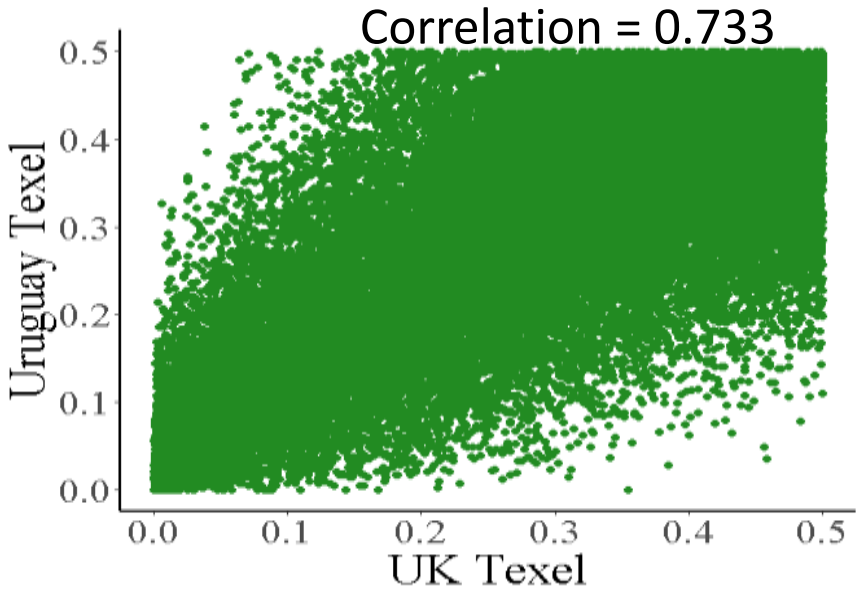
Harmonisation



Harmonisation







Across-country evaluation

3 case studies: meat sheep, dairy sheep, dairy goats

- Documenting issues (ID, phenotypes)
- Genetic correlations across country
- Run animal model BLUP / SSGBLUP from raw phenotypes.
- Multi-trait analysis

Framework developed to quantify the benefit of international sharing of germplasm. Case-study Ireland & NZ. To be used in other case-studies


Fetherstone et al. Genet Sel Evol _ ##########_
https://doi.org/10.1186/s12711-020-00594-y

GSE Genetics Selection Evolution

RESEARCH ARTICLE Open Access

Genetic and economic benefits of foreign sire contributions to a domestic sheep industry; including an Ireland-New Zealand case study

Nicola Fetherstone[1,2*], Fiona S. Hely[3], Noirín McHugh[1], Fiona M. McGovern[1] and Peter R. Amer[3]

This project has received funding from the European Uni

Across-country evaluation

Illustration of **phenotype issue** (goat case).
Heterogeneous phenotypes for the same trait (eg. Dairy traits)

- Canada:
  - **Test-day** data (milk production)
- France:
  - **Lactation** data (milk production)
- Switzerland:
  - **Lactation** data cut **in two parts** (1-100 days and 101-220 days)
- Italy:
  - **Lactation** data but **precorrected** (milk production)

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Main output regarding ICAR community

- ✓ **Guidelines** for efficiency and resilience traits in small ruminants

- ✓ Creating an international initiative and preparing necessary procedures to facilitate, encourage and motivate cooperation in international evaluations in small ruminants
  - **~INTERRAM / INTERBUCK**
  - **Zootechnical Reference Centre for Small Ruminants**

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Creating an international initiative for across country evaluation in small ruminants

- Technical lessons from the case-studies
  - Way to address the issues
  - Strategy for across country evaluation
  - Assessing the genetic links between countries

- OPPORTUNITIES and RISKS of international evaluation in small ruminants
  - Survey within SMARTER partners
  - Complete and (very) interesting panel of arguments / opinions / comments
  - Survey to be extended to other stakeholders

INT'L EVALUATION : OPPORTUNITIES & RISKS

OPPORTUNITIES

Increase the rate of genetic gain in many countries

More rapidly address some of the **health, welfare, disease and environmental** impact challenges

Get EBVs from abroad on the domestic scale

Fair exchanges across countries

International **collaboration** and sharing of knowledge. **Networking** between stakeholders

Harmonisation of phenotype recording

INT'L EVALUATION : OPPORTUNITIES & RISKS

RISKS

Lack of genetic links between countries
What if **GxE**?

Promote a few breeds of wide commercial applicability v. local **breeds**

Unbalanced benefits. Risk that sale of genetics would **only** be **one way**

Too expensive and time consuming for small ruminant sector (**cost-benefit balance**?)

Loss of independence on evaluation => **maintaining national research groups needed / preferred**

"There are risks, but the risks can be mitigated if this is recognised up front"
=> Work on how to mitigate the risk

SMARTER PARTNERS

Thank you for your attention

www.smarterproject.eu

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