SMARTER

SMAll RuminanTs breeding for Efficiency and Resilience

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Report of the final scientific conference

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1 Summary

The SMARTER's final conference has been organized in Spain in convergence with ICAR's conference on "Breeding for resilience: transitioning diverse livestock farming systems into the future". The fact ICAR had, independently, chosen to organize its annual conference on a similar theme reveals the impact of the SMARTER project within the framework of current scientific themes in Europe. This is why SMARTER had decided to choose this moment and that place for its final meeting.

2 Introduction

The SMARTER's final scientific conference has been organized on 22nd - 23rd May 2023 at the Palacio de Congresos de Toledo "El Greco" (Toledo Congress Centre El Greco). The choice of this moment and of this place can be explained in the following way:

1. An important international conference on a closely related scientific theme was programmed in Toledo just a few weeks before the end of SMARTER, namely ICAR's (International Committee for Animal Recording) conference on "Breeding for resilience: transitioning diverse livestock farming systems into the future" which lasted from 22nd to 26th May.

2. Another European project, RUMIGEN, had planned to organize its 2nd Annual Meeting at the same moment. There was also a convergence between the theme of this project and SMARTER's. Its aim was to develop new breeding strategies to help ruminants to adapt to climatic changes.

3. Last but not least, the network ERFP (European Regional Focal Point for Animal Genetic Resources), which is network of national coordinators and experts around animal genetic resources, which gathers its working groups once a year, had also one of its annual meeting in the same place at the same moment. These experts were representatives of their ministries (of agriculture in general), scientists and/or academics working on genetic resources, representatives of NGOs for endangered breeds and animal genetic resources, as well as representatives of international organizations such as FAO (Food and Agriculture Organization) and EFFAB (European Forum of Farm Animal Breeders).

   Hence there was a quadruple interest in organizing SMARTER's final conference in that place at that moment:

   a. Two kind of publics were gathered: scientists as well as stakeholders interested in the robustness of the animals, and in their breeding for resilience and efficiency. And the main aim of SMARTER's dissemination strategy since the beginning of the project is to try to reach as well the scientific community, as the stakeholders (breeders, sheep and goat farmers, inter-professional organisations, technical institutes, NGOs, ministries, etc.).

   b. There was a strong thematic convergence (ruminants genetics and their adaptation and resilience)

c. Specialists of other projects could assist to public SMARTER's sessions, with the exception of the Executive Committee, were public, and the partners of SMARTER's project could disseminate their results as well through interventions in the other conferences and workshops, as well as during their informal conversations with the specialists of the other projects during the breaks.

3 Organization of the conference

The SMARTER's final scientific conference (see the detailed agenda in Annex 1) took place on 22nd - 23rd May 2023, in Toledo at the Palacio de Congresos "El Greco".

The conference was attended as follows:

- 59 project partners;
- 12 stakeholders;
- 112 participants took part to the presentation of the results of SMARTER's WP4 at the joint SMARTER - ERFP - RUMIGEN session;
- 100 participants were present at the ERFP open session on: "What is happening in the field of AnGR in Europe?" - Strategies and activities from ERFP & EURC EAB and Interbull Reference Centres;

4 Discussions

28 presentations were made during the conference by the researchers taking part in the project, all presentations will be available on SMARTER website by mid-July 2023.

The agenda was structured as follows:

- WP1: for feed efficiency, establishing from which proxies possible predictions of animal feed efficiency can be made is not an easy task. Working on feed efficiency is less easy than on resilience. But interesting results have been found concerning the fact that proxies based on blood predict better than the one based on rumen

- WP2: the major highlights were the first genomic breeding values obtained for foot rot and mastitis in UK Texel sheep, the first genome-wide study on the genetic architecture of lifetime resilience in Chios sheep, and the discovery of several homozygous deficiency regions associated with early survival in 3 dairy sheep breeds.

- WP3: focused on the trade-offs between efficiency and resilience, showed how no major systematic antagonisms between R&E were detected (from different approaches developed in WP3, including metanalyses and modelling) which is good news as it will allow balancing selection for both resilience and efficiency in future work in the field

- WP6: produced the first across country evaluation methodology for small ruminants, highlighting its weaknesses and strengths and potential for future growth. This is a major achievement based on international cooperation which will improve and increase the speed at which small ruminant research can be done. On top of this, a list of common SNPs panels was identified and illustrated how it is possible compare SNPs coming from different populations.

- WP5: focused on the impact of genomic modelling on the methods of selection for resilient and efficiency traits. The project has shown that simultaneous genetic improvement in both traits greatly benefits from the use of genomic evaluation, reaction norm models and phenotyping in a wide range of environments. Genomic selection coupled with reaction-norm models offers great opportunities to simultaneously improve productivity and resilience of farmed animals

- WP7: focused on balanced-breeding goals for agro-ecological resilience. Simulations were used to assess different farm scenarios under different conditions to select for R&E traits with results showing that with the SMARTER model, economic performances of farms were improved, production was increased and management by the farmer was not have to be altered. Surveys were also sent to breeders and stakeholders which furthered the understanding of their trait preferences and their view on what the optimal animal could look like. These models and surveys could really be useful to select optimal conditions/traits which can deal with the challenges of the future. Globally WP7 has shown that SMARTER's model works well, and is adaptable to different systems and breeds. The work package has shown also that even if all breeders do not have the same level of genetic knowledge, they all nevertheless have expectations in terms of animal performance for resilience and efficiency.

- WP4: the importance of the project results concerning the researches on the genetic diversity and the history of the demography of underutilised breeds have made possible to organize a joint session with ERFP, ICAR and RUMIGEN participants. These

results make appear mainly the relations between breeds, e.g. between Irish and Nordic breeds, or the fact that Greek breeds are genetically situated between Asian and European breeds. Some genetic traits of Greek breeds might explain the high adaptability of these breeds. The collaborative effort from the partners in the WP to produce a sizeable online data repository composed of both foreground and background data to facilitate characterisation analyses.

The meeting ended with an insightful round table discussion among the WP leaders regarding the accomplishments of the SMARTER project. They reflected on the various achievements and milestones reached throughout the project's duration, acknowledging the positive impact their collective efforts had on addressing societal challenges. The participants also explored potential opportunities beyond the project's completion, brainstorming ideas for further utilisation and expansion of the project outcomes.

The conclusions were focused on the question: how to transfer SMARTER's model and results? A participant underlines the necessity of having a business plan after the end of such a project, in order to continue the dissemination of its results. The results begin to be implemented in some national programs, for instance in the UK. But more must be done in terms of implementation, and this work must be achieved principally though cooperation, rather than at a political level. For the industry for instance, the needs must come from the firms themselves, for other groups of professionals EIP Agri operational groups must be used. The project has shown also the necessity of reaching certain publics at a local level, though local languages, and at a simpler level of knowledge. Some participants underlined the difficulties of this task, since professional associations organizing the round tables do not always have the adequate knowledge and skills to present the project and its results, the right speakers have to be defined, and the differences are huge between big countries (such as UK) and small countries (such as Norway). This means that openness is necessary, and also having the sense of institutional and linguistic differences.

5 List of the stakeholders present in Toledo

The following stakeholders took part in the conference for their organizations:

- Spain: ASSAFE, IGA - International Goat Association, INATEGA SA (Animal Health and Feeding), CONFELAL
- United Kingdom: National Sheep Association

- Italy: AIA (Italian Association of Breeders)
- Hungary: Hungarian Sheep and Goat Products' Council
- Belgium: (European level): EFFAB
- Australia: AGBU, Animal Genetics and Breeding Unit
- Sweden: Interbull Center
- France: FACE Network (Farmhouse and Artisan Cheese & Dairy Producers European Network)
- US: CDCB (Council on Dairy Cattle Breeding)

6 The openness of WP4 to ERFP and to Rumigen

One of the important moments of the conference was the open presentation of WP4 to the other projects and conferences organized at the same moment in the El Greco Conference Centre. This presentation was focused on the characterization of hardly or underutilised breeds' environmental adaptation, and concerned ERFP as well, a European regional focal point concerning the animal genetic resources (a platform for management, the conservation and the sustainable use of these resources). Three publics were gathered:

- The participants to SMARTER's final conference
- The participants to ERFP Toledo workshop

This ensured a dissemination simultaneously towards the scientists of other projects, to the different kind of experts present in the ERFP Network, and to the European stakeholders of SMARTER's project.

7 Participation of SMARTER researchers to the other conferences: ERFP and ICAR

It must be stressed also that SMARTER's participants took part also in two other conference's sessions:

- At the very end of the second day, there was an open session organized by the ERFP on the theme: "What's new around genetic resources" to which they had invited representatives of RUMIGEN, SMARTER and the ICAR working groups.
- But several SMARTER's participants took also part in the ICAR's Conference on "Breeding for resilience: transitioning diverse livestock farming systems into the future". This was especially the case for: Jean-Michel Astruc (INRAE) of WP6 who was president of two sessions within the conference, and made three other interventions, but also of Nicolas Friggens (INRAE), Eva Ugarte (NEIKER), Donagh Berry (TEAGASC), Timothy Byrne (Abacusbio) who made each an intervention.
- Two SMARTER's stakeholders made also interventions within the ICAR Conference, this is the case for Mauro Fioretti (AIA) and Maite Lasarte (CONFELAL).

8 Conclusions

The choice of organizing the SMARTER final conference in connection with the ICAR annual meeting in Toledo was made to maximize the exchanges with stakeholders (European associations, breeders, sheep and goat farmers, inter-professional organisations, technical institutes, NGOs, ministries, etc.). This objective seems to be reached since:

- The project results have been disseminated to both scientific and stakeholders' communities
- The stakeholder's participation was good.

Participants are well aware of the fact that a lot remains to be done in terms of SMARTER's model and results. They have analysed also the difficulties of this transferring, in terms of knowledge competences and skills, institutional and linguistic differences.

The participants also explored potential opportunities beyond the project's completion, brainstorming ideas for further utilisation and expansion of the project outcomes such as:

- To start implementing project results in some national programs, for instance in the UK
- To implement project results though cooperation, rather than at a political level; at industrial level, the needs must come from the firms themselves; for other groups of professionals EIP Agri operational groups could be used.

Eventually, most collaborations developed in the project are still operational which bodes well for the continuation of the work beyond SMARTER. The impact of SMARTER is poised to resonate well beyond its completion, driving sustainable innovation and progress in the field of small ruminants in Europe and beyond.

Annex 1 - Agenda of the final conference

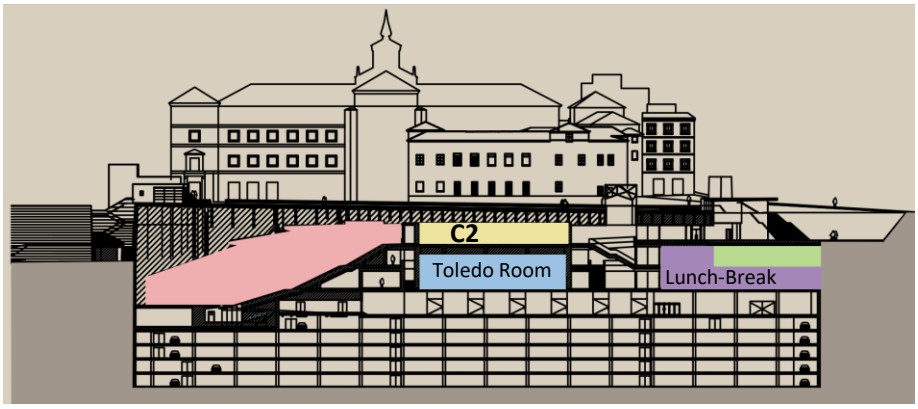
SMAll RuminanTs breeding for Efficiency and Resilience

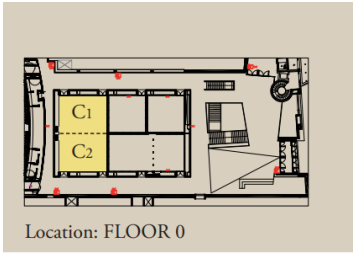
Final Meeting - Agenda

22 & 23 May 2023 – Toledo, Spain

Meeting rooms:

- **Main meeting room: C2**
- **Lunch & coffee breaks in Zocodover space (purple)**
- **WP4 & ERFP: Toledo room (blue)**





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	SUBJECT	SPEAKER
	MONDAY	
11:30-01:30	CLOSED SESSION - EXCOM	Rachel Rupp (RR) Maryon Wallet (MW)
02:00-02:15	**Opening Final and General Meeting**	Rachel Rupp (RR) Maryon Wallet (MW) Riccardo Carelli (RC)
02:15-03:30	**WP1 - Novel traits to improve resource use efficiency** 1/ Intro: Feed efficiency in small ruminants; genetic basis and novel traits for a complex traits 2/ Phenotypes related to FE in small ruminants 3/ Genetic determinism of feed efficiency in small ruminants 4/ Genetic correlations between feed efficiency and production traits in small ruminants 5/ GxE interaction for feed efficiency related phenotypes in small ruminants	1/ J.J. Arranz (JJA) 2/ Ch. Marie-Etancelin (CME) 3/ J. Conington (JC) 4/ G. Ciappesoni (GC) 5/ S. Vouraki (SV)
	COFFEE BREAK - 30 mn	
04:00-05:15	**WP2 - Novel resilience traits to improve health and welfare Task 1 - Health and disease phenotypes** T2 - Survival of fetus and young animals T3 - Behavioral adaptation traits T4 - Lifetime resilience	1/Joanne Conington 2/Arnaud Delpeuch (AD) 3/Sotiria Vouraki 4/Karolina Kaseja (KK)
05:15-06:30	**WP3 - Genetic of trade-offs and synergies between resilience & efficiency related traits** 1/ Toward genetic selection for resilience based on milk metabolites 2/Towards a resource allocation model for dairy goats building on SMARTER data 3/Modelling the energy cost of host resistance to gastrointestinal parasites in meat sheep 4/Evaluation of novel resilience phenotypes based on longitudinal performance measure	General Intro: R. Rupp & A.Wilson (AW) 1/ M. Ithurbide (MI) 2/ N. Friggens (NF) 3/ F. Douhard (FH) 4/ M. Ghaderi Zefreh (MGZ)

SOCIAL DINNER - El Ábside en Toledo C. Marqués de Mendigorría, 1, 45003 Toledo, 21pm		
	TUESDAY	
9:00-10:15	**WP6 - Practical selection tools to benefit from international cooperation** 1/ SNP panel in sheep from allele frequencies in SMARTER breeds 2/ Across-country evaluation 3/ International initiative for harmonisation and international evaluation	1/ Donagh Berry (DB) 2/ Andrés Legara (AL) 3/Jean-Michel Astruc (JMA)
	COFFEE BREAK - 40 mn	
11:00-12:15	**WP5 - Genomic/genetic modelling and methods of selection for resilient and efficiency traits** 1/ General overview 2/ Main results from INRAE and partners 3/ Main results from UEDIN and partners	1/ Ricardo Pong-Wong (RPW) 2/ Andrès Legara
12:15-01:30	**WP7 Balanced breeding goals for agro-ecological resilience** 1/Delivering more aligned breeding goals for small ruminants in Europe 2/ Modelling farm performance under infectious and non- infectious challenges 3/Farmers' practices and preferences for breeding and Genetics 4/ Breeding program modelling for resilience & efficiency in Lacaune sheep	1/ Tim Byrne (TB) 2/ Alexandros Theodoridis (AT) 3/ / Vincent Thenard (VT) 4/ Tim Byrne
	LUNCH	
02:30-03:45	**WP4 Genomic characterization of hardy or underutilised breeds' environmental adaptation using existing and wely generated data** 1/ Intro 2/ History and migrations of north-western European breeds 3/ Genetic diversity of Greek breeds, relationships with Asian and European populations (12') 4/ Estimating adaptive effects in multiple population genetic data, application to local Sheep Breeds	1/ Bertrand Servin (BS) 2/ Arianna Manunza (AM) 3/ Valentina Tsartianidou (VT) 4/ Lucy Peters (LP)

	COFFEE BREAK - 20 mn	
04:10-5:00	Debrief - Conclusion	Rachel Rupp (RR) Maryon Wallet (MW)
05:30-06:30	ERFP Seminar Open session: What is happening in the field of AnGR in Europe? Strategies and activities from ERFP & EURC EAB and Interbull Reference Centres	
	ERFP COCKTAIL	

Annex 2 – Presentations used during the meeting

The public presentations made during the Toledo meeting are available on https://www.smarterproject.eu/