

SMARTER

SMALL Ruminants breeding for Efficiency and Resilience

Newsletter – Issue 4



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2nd Annual Meeting – by C. Moreno

Due to the Covid19 crisis, the SMARTER 2nd annual meeting was postponed to summer 2021 in Leon University (Spain). We organized virtual meetings for WP1-8 (2-3h meeting/WP) in December and a plenary session was organized for January 14th to summarize the WP1-8 sessions and to give information about management (WP9), ethics and data protection (WP10).

Globally, the project was slightly impacted by the lock-downs in the different countries. One year delay is necessary for some experiments of WP1, 2 and 3. Most of the work was done on time and promising results from experimental works were presented at a dedicated SMARTER session at EAAP 2020. A total of 17 peer-reviewed papers have been published or submitted for publication. The number of papers per Work Package (WP) are: WP2 (5), WP3 (2), WP5 (8) and WP6 (2) and a remarkably fruitful output has been generated from WP3 and WP5 (10 papers!). The agreement to share data in WP6 was signed and the exchange of genotyping and pedigree data was almost completed. The stakeholder platform was created in WP8 including 30 participants.

Thanks to the late acceptance of the amendment by EU (June 2020), we now have two new partners in the project which are CNR for WP4 and AbacusBio for WP7 respectively. Consequently, the work has begun in these WPs but no major results were presented so far.

To conclude, there are a lot of interactions between SMARTER partners, many more than originally anticipated! These include a metanalysis in WP3 lead by INRAE and SRUC, an exchange of data to perform an international evaluation (WP6), detection of lethal mutations in goats (WP2), and shared survey/interview data between countries in WP7. It also has included new data coming from several partners (INRAE, University of Leon and INIA-Uruguay) to develop new models and methods. The lock-downs due to Covid19 virus seem to have motivated these new collaborations between partners. Unfortunately, we have not had any contact with 2 of our original partners (CAS and Buas) with whom we have not had contact for more than a year despite our reminders.





Credits: Stéphan Gabrielli

There were 12 theatre presentations and 8 posters presented during the SMARTER session of EAAP meeting (Session 61). These presentations were undertaken by 7 SMARTER partners (INRAE, SRUC, TEAGASC, UNILEON, UEDIN, INIA-UY, UGUELPH) with the participation of 5 other partners (IDELE, NSG, NEIKER, AUTH, ABACUSBIO). Most of the presented results are not yet published in an international review but gave interesting information concerning the genetic parameters of resilience and efficiency (R&E) (5 talks), and the genetic evaluation of these traits (5 talks). There were also 2 presentations about mutations or QTL detections of R&E and 3 papers studying the mechanisms/genes underlying trade-offs between R&E. Finally, 4 'methods' papers were presented that included 2 models for trade-offs and selection strategy, 2 new methods for resilience trajectories and the accuracy of resilience. Despite the unfriendly virtual environment, the session was a real success (Around 80 participants followed our session) and showed the great work done this year by the SMARTER partners. All the presentations are available on [SMARTER website](#).

Practical Selection Tools to Benefit from International Cooperation (WP6) – Updates – by J.M. Astruc, D. Berry

A plenary WP6 meeting was held on 15 December 2020 and the main outcomes were presented at the Wrap Up meeting on 14 January 2021.

As the prerequisites for setting up international evaluation are mainly achieved, the across-country evaluation will be implemented in 2021. Pedigree and phenotypic data (and in some cases genomic data) have been pooled together for the three case-studies: in meat sheep (Charollais, Vendéens, Texel, Suffolk from Ireland, the UK and France), in dairy sheep (Spanish Latxa and French Manech) and in dairy goats (Alpine and Saanen from France, Canada, Switzerland and Italy). The level of connectedness among countries have been assessed. Each case-study will run BLUP and SSGBLUP animal model from, using a multi-trait evaluation (each country being considered as a different trait) based on phenotypes, on at least one efficiency-related trait and one resilience-related trait. Variance components and genetic correlations across country will be estimated, EBVs produced. Technical solutions and issues related to genetic evaluation and data edition (exchanged files, ID problems) will be documented for future possible routine evaluation.

The research on allele frequency across country x breeds in sheep was presented with updated populations (10 meat sheep populations from 4 countries and 8 dairy sheep populations from 2 countries). Countries that would like to pool their populations can do it by sending their genomic data to Aine O'Brien (Teagasc) as soon as possible.

Meanwhile, a survey on opportunities and risks of multi-country evaluation was conducted in SMARTER partners. An interesting list of arguments / opinions / comments were collected on genetic issues, exchanges and collaborative issues, externalities, financial aspect. Besides a lot of opportunities, it is important to deal with one potential risk for the countries, which is the loss of independence on evaluation if international evaluation is run by a third party (eg. international evaluation centre); maintaining national research groups



seems needed and preferred. Such survey will be proposed to farmers and organisations of SMARTER countries, as well as to the stakeholders of the platform. The results will be useful to write the business and operation model for routine international evaluation in the future.

Finally, the tool developed by Teagasc to quantify the benefit of international sharing of germplasm (through the Ireland and New Zealand case-study) was presented and proposed to be used in other case studies within SMARTER (see the dedicated article in this Newsletter).



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Case study: Can the Irish sheep industry benefit from using New Zealand genetics? - by N. Fetherstone, F. Hely, N. McHugh, and P. Amer

Using a gene flow model, it was investigated whether the Irish sheep population would benefit from elite maternal germplasm sourced from Irish or New Zealand flocks, and if so, how best to incorporate that germplasm to maximise genetic gain. The model quantified the genetic improvement, in monetary terms, across future generations of commercial sheep as a consequence of the implementation of alternative breeding strategies. Various subpopulations were modelled reflecting the current structure of the Irish sheep population. A base scenario was modelled assuming no change to current breeding strategies. A progressive scenario modelled the impact of the shift of market share away from conservative breeders towards progressive breeders. A New Zealand scenario investigated the impact of importing New Zealand rams every 5 years that were elite for maternal genetic merit. The greatest monetary gain was achieved by the progressive Irish scenario, which had the potential for a four-fold increase in monetary gain compared to the base scenario. For the strategy that imported elite New Zealand germplasm, the benefit was almost 3 times greater than the base scenario. The long-term impact of the importing elite New Zealand germplasm was hampered by the foreign population having a poor long-term genetic trend and therefore benefits quickly plateau. Results demonstrate the potential to accelerate the benefit to the Irish sheep industry without the use of imported germplasm, but through the strategic use of progressive domestic genetics, i.e. shift market share away from conservative breeders towards progressive breeders. However, the exploitation of imported germplasm, such as elite New Zealand rams, may play a key role in triggering this shift. The gene flow model now acts as a template for other scenarios or even industries to quantify their genetic and monetary benefits from importation strategies regardless of country or species.

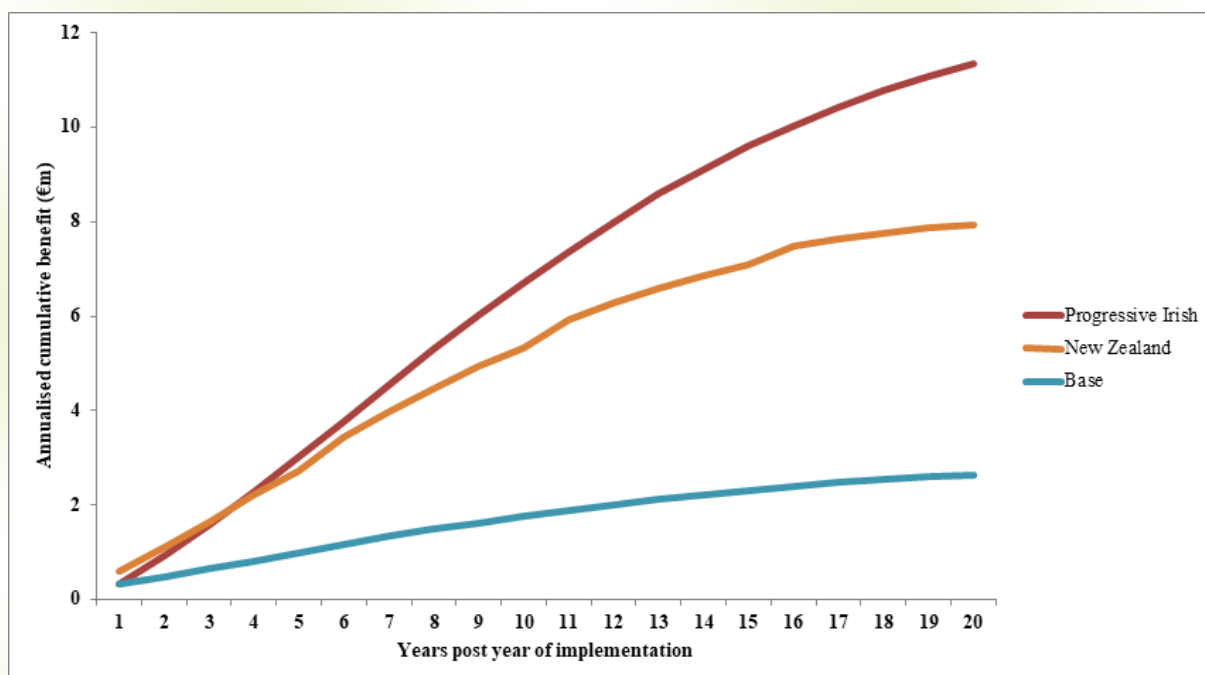


Figure 1: Annualised cumulative benefit (expressed in € millions) from year 1 to 20 post-implementation of the base, the Progressive Irish and the New Zealand scenarios.

INIA UY participation on The European Researchers' Night – by G. Ciappesoni

INIA Uruguay participated in the [Iberoamerican Researchers' Night](#) (part of European Researchers' Night) with the proposal “Spain-Uruguay linked by sheep: from the Adelantados to genomics”. It was an activity aimed at high school students and the general public. This presentation showed some of the genetic and cultural links between both countries with a view from sheep production, with an emphasis in the Basque origins. The current research proposal related to the SMARTER, GrassToGas and RUMIAR projects was also presented. [The full presentation can be found on YouTube](#) (more than 500 visits) where there are testimonies from farmers with Basques origin telling their family history.



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Stakeholders activities – by C. Mosconi

In 2021, the dissemination activities for stakeholders will be focused on the ten National Round Tables to be organized in the second part of the year and on the ICAR Annual Conference to be held in Leeuwarden (26-30 April).

The ten national round tables (NRT)

In the second part of 2021 until the first months of 2022 National Round Tables (NRT) will be managed in ten SMARTER countries with the purpose to reach all relevant stakeholders within each country (end-users, sheep and goat farmers, breeding, (inter)-professional organizations, training people, wide society) to the same table for presenting and discussing the achievements of the Project

The structure of each NRT is common and can be summarized as it follows:

- Agenda
- Presentation of the Organizations of the participants
- Presentation of the WP practical results, through slides prepared by of the different WPs leaders translated into the local language
- Flexible presentation according to the specific interest of each countries (traits-oriented, evaluation-oriented, breeding objective-oriented). The aim being to present and discuss objectives, practical results for end-users, way of disseminate.
- Survey (from WP7) for getting feedbacks from the participants, in order to improve the replies of the different questionnaires set up during the project.

All the collected feedbacks, ideas, suggestions in the various NRT will be collated into a final document that facilitate the application of the achievements of the SMARTER. A sufficient time for discussion and round tables besides the plenary presentations is a key point to provide the right communication to the participating stakeholders. Interviews of farmers, end-users on their perception of the project should be welcome.

ICAR Annual Conference, April 2021

In Leeuwarden (the Netherlands), a specific session dedicated to SMARTER will debate the latest achievements on "Resilience and Efficiency in Small Ruminants". Around 200 experts are expected in the Conference while more than 200 participants will join the meeting on remote. In order to facilitate the assistance, from the Americas, the Conference will be organized from h. 19.00 on. The timing has been identified also for helping a wider involvement from Asia and Oceania.

In general, the conference is dedicated to circular farming and its impact on animal genetics, recording of data and cattle / herd management.

Some interesting ICAR sessions are scheduled, involving the impact of circular farming on breeding and breeding goals, the recent developments in animal identification, data analytics, new opportunities through milk analysis, new developments in milk recording, possible applications of blockchain in recording activities, on goat and sheep performance recording and on their resilience.

Due to the target of the participants, a session of the Annual Conference is dedicated to the SMARTER Project and six manuscripts have been already submitted.



PhD students in SMARTER project: Quentin Le Graverand, Camila Balconi Marquez, Gracialda Ferreira

Quentin Le Graverand (PhD student – INRAE)



Title of the thesis: Identification of predictors for the genetic evaluation of feed efficiency in meat sheep (*This PhD Thesis is supported by the SMARTER and GrassToGas project*).

Feed efficiency is an important trait to include in breeding programs given its impact both at the economic and environmental levels. Currently, the ability to select for feed efficiency depends on the ability to record daily feed intake. In small ruminants, this phenotyping is not yet well developed, particularly because of cost. The objective is thus to identify biological markers able to predict feed efficiency. Quentin will work on fine phenotypes collected on divergent lines for Residual Feed Intake, a criteria of feed efficiency. These lines are being developed in the Romane meat sheep breed at the experimental unit P3R – Bourges. On individuals belonging to the 2nd and 3rd generations of selection, we collected blood for genotyping (54 k SNP chip) and metabolomics analyses, rumen fluid for microbiota and metabolomics analyses, and fecal sample on which NIRS are performed. All these samples are collected twice per individual: first after a 6 week-period of control under a concentrate diet, and then after another 6 week-period of control under a total mixed ration including 2/3 of hay and 1/3 of concentrate. Quentin will analyse all these fine phenotypes in relationship with residual feed intake, and will integrate them to predict feed efficiency.

Camila Balconi Marques (PhD student, INIA fellowship)



productive traits in sheep”. Besides this work, she is an excellent singer and guitar player!

With Brazilian origins, Camila Balconi Marques graduated as a Veterinarian at the Federal University of Santa Maria in 2017 and has a master’s degree in health and reproduction in the same University (2017-2018). Currently, develops the initial stages of his PhD’s degree at the National Institute of Agricultural Research (INIA - UY), under the guidance of Ing. Agr. PhD Gabriel Ciappesoni, Ignacio de Barbieri and José Velazco. The thesis is part of the SMARTER (WP1 and 3) and RUMIAR Project (INIA-UY), entitled “Estimation of genetic parameters for feed intake, RFI and methane emission and its relationship with

Gracialda Ferreira (PhD thesis, INIA)



On July 10, 2020, Dr. Gracialda Ferreira de Ferreira's MSc Thesis “Consequence of divergent selection due to resistance to gastrointestinal parasites in sheep on feed intake and feed efficiency” was approved with the highest qualification and with honors! Congratulations Gracialda! Currently a scientific article of this thesis is under review.





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