SMARTER
SMAll RuminanTs breeding for Efficiency and Resilience

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Schedule and program of the summer school, eLearning and training sessions and multi-actor round tables

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DELIVERABLE D8.4

Work package N°8
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About the SMARTER research project

SMARTER will develop and deploy innovative strategies to improve Resilience and Efficiency (R&E) related traits in sheep and goats. SMARTER will find these strategies by: i) generating and validating novel R&E related traits at a phenotypic and genetic level ii) improving and developing new genome-based solutions and tools relevant for the data structure and size of small ruminant populations, iii) establishing new breeding and selection strategies for various breeds and environments that consider R&E traits.

SMARTER with help from stakeholders choses several key R&E traits including feed efficiency, health (resistance to disease, survival) and welfare. Experimental populations will be used to identify and dissect new predictors of these R&E traits and the trade-off between animal ability to overcome external challenges. SMARTER will estimate the underlying genetic and genomic variability governing these R&E related traits. This variability will be related to performance in different environments including genotype-by-environment interactions (conventional, agro-ecological and organic systems) in commercial populations. The outcome will be accurate genomic predictions for R&E traits in different environments across different breeds and populations. SMARTER will also create a new cooperative European and international initiative that will use genomic selection across countries. This initiative will make selection for R&E traits faster and more efficient. SMARTER will also characterize the phenotype and genome of traditional and underutilized breeds. Finally, SMARTER will propose new breeding strategies that utilize R&E traits and trade-offs and balance economic, social and environmental challenges.

The overall impact of the multi-actor SMARTER project will be ready-to-use effective and efficient tools to make small ruminant production resilient through improved profitability and efficiency.

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1 Summary

The D8.4 concerns the pre-program and content of the SMARTER summer school/eLearning and the round tables.

The summer school will take place in March 2023, will last four full days and will be structured in four modules all related to core project activities.

The 9 round tables will be organized in the period April - December 2022 and will last 1-2 days each.

2 The summer school/e-Learning

The summer school will last four full days (one day for each module) and will take place in Toulouse in March 2023 (indicatively from 2 to 31). The aim is to organize the summer school in presence, however, the final decision will be taken within December 2022, in accordance with the COVID situation.

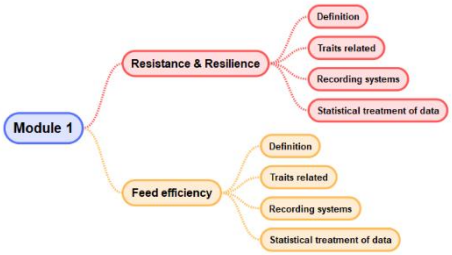
The summer school is aimed at animal scientists (post-graduate level or above) and professionals in the field of livestock production. The course may be also of interest for genetic researchers who wish to broaden their skills and knowledge of these systemic and global issues.

The foreseen number of attendees for the summer school is 20 trainees if organized in presence.

Moreover, each module of the summer school will be video-recorded and transformed into eLearning module, uploaded into the SMARTER YouTube channel and make available for those who cannot attend the summer school.

Module 1 Traits and methods to compute phenotypes

Course description:



The module will cover basic principles for definition of traits related to resistance and resilience (R/R) and feed efficiency traits, recording systems for these traits, together with relevant examples in different SMARTER's countries:

- Definition of resistance and resilience in small ruminant (theoretical and genetic basis)
- Traits related to resistance/resilience (theory and practical examples):

  The "gold standard" FEC at different ages, in farm or experimental stations, natural vs artificial infestation. Other traits: Dag Score, FAMACHA, IgA, etc.
- Recording systems for R/R: examples in different countries and breeds.
- Statistical treatment of raw input data (R/R): transformation/normalization, repeated measures vs multi-trait, etc.
- Definition of feed efficiency (theoretical and genetic basis)
- Traits related to feed efficiency: Feed intake (forage, grain), RFI, Growth, water consumption, etc.)
- Recording systems for feed efficiency: examples in different countries and breeds.

- Statistical treatment of raw input data (feed efficiency / growth): quality control for biological inconsistences, detection of outliers, etc. Single vs repeated measures.

Course teachers:

Rachel Rupp, Carole Moreno, Flavie Tortereau (INRAE, France)

Gabriel Ciappesoni, Ignacio de Barbieri, Elly Navajas (INIA – Uruguay)

Nicola Lambe (SRUC, UK)

Juan José Arranz (UniLeon – Spain)

Noirin McHugh or Donagh Berry (TEAGASC – Ireland)

Module 2: Mechanistic and statistical modelling of resilience and feed efficiency

Course description:

Mathematical modelling has become a valuable tool in the analysis of resilience and feed efficiency and to support the development of control strategies. This module will introduce the conceptual ideas and mathematical tools needed for formulating and evaluating mathematical models for resilience and feed efficiency in farmed animals. A hands-on approach will be adopted in form of interactive lectures and tutorials. The module will cover fundamental principles of statistical and mechanistic resilience and feed efficiency models, together with relevant examples including

- General introduction to statistical and mechanistic mathematical models (ADW
- Mechanistic models of trade-offs determining variation in resilience and feed efficiency (LP)
- Statistical models of resilience trajectories (NF)
- Reaction-norms and other statistical approaches for modelling disease resilience of animals (ADW)
- Modelling resilience of sheep to gastro-intestinal parasite infections (FD)

The course will provide participants with the relevant theory of mathematical modelling of resilience as well as with hands-on experience with relevant modelling techniques. Upon course completion, participants can expect to have a basic understanding of the purpose, essential building-blocks, assumptions and limitations of different types of mathematical models, have the fundamental knowledge to build mathematical models from scratch and analyze the model behavior, and will be able to interpret published results from diverse modelling studies.

The course is aimed at animal scientists (post-graduate level or above) and professionals in the field of livestock production or health with good numeracy skill and an interest in quantitative approaches to study infectious diseases. The course is not aimed at researchers with advanced modelling skills.

Course teachers:

Andrea Doeschl-Wilson (The Roslin Institute, University of Edinburgh, UK)

Nicolas Friggens, Laurence Puillet, Frederic Douhard (INRAE, France)

Module 3 - Detecting Stress and evaluating ability to cope with stress

Course description:

Animals are exposed to stresses such as heat or management problems that may be measured or not. These stresses can be quantified and used in a norm reaction model to evaluate animal's ability to cope with stress. In addition, using frequent (e.g. daily) longitudinal data on traits, it is possible to infer the occurrence of unrecorded stresses based on deviations from the trajectory - either individual or group based.

The objectives of the module are:

- to present the norm reaction model to evaluate how animals deal with stresses when stresses are directly measured
- when stresses are not measured, how to infer and quantify their existence using deviation from trajectories, either of a group or of an individual
- how to include these inferred stresses into the norm reaction model for resistance to stress

In addition to some lecture, we will use INRAE data and UNEDIN simulation for a hands-on approach.

Course teachers:

Andrea Legarra, Carolina Garcia-Baccino (INRAE, France)

Masoud Ghaderi-Zefreh, Oswald Matika, Ricardo Pong-Wong (UEDIN, UK)

Module 4: How can resilience and efficiency traits impact system performances and modify farmers' breeding choices?

Course description:

In the animal breeding process, the system level is very important because different aspects can be modified by the availability of new resilience and efficiency traits: economic results, environmental impacts, farmer choice and farming practices. This course module focuses on two different methods: modelling and surveys, and two approach for each method.

Redesign of farming systems to switch towards more sustainable and resilient sheep and goat production using modelling.

The first approach is based on the development of **a farm-scale mathematical simulation model**. This model is implemented for sheep and goat farms and its outcomes will be presented. This whole-farm model simulates how changes to optimize one component of the farm (e.g. animal level genetics) will impact sustainability issues in other components and the overall system (e.g. gross margin, labor requirements, land use, grazing, profit etc.). The Model constitutes a very useful tool for policy-makers to identify innovative strategies that can be proposed to re-design S & G farming systems. The structure and the main features of the model as well as the required data for its implementation will be described in detail and the results of the implementation of the model under alternative scenarios using real-farm data from ***Chios sheep breed*** will be analyzed.

The second approach uses OSIRIS, **a bio-economic model**, that allows to define an economic breeding goal for ruminants by estimating the economic values of traits for a particular system

and breed in today's context. The very detailed description of the functioning of the system (replacement and culling policy, fertility rates, health costs, mortality rates, etc.) allow to model the profit for a typical herd management. The model includes equations of income and costs related to several traits that can be genetically improved for breeding and production and so be part of breeding objectives. Then, the economic values can be defined as the first derivative of the herd profit function regarding each individual trait. The architecture of the model as well as the main parameters required will be described. The results of the modelling for a system in the French ***Lacaune milk sheep breed*** will also be detailed.

Understand farmers' choice to use new breeding traits for more sustainable livestock production using surveys.

The first approach uses **choice modelling** for understanding the farmer's needs. Knowing breeders' preferences for selection traits allows designing research and development programs that fit with breeders need. We will present the method called "choice modelling" for collecting individual preferences and mapping their diversity within a population. We then give an outline of the results obtained with this method in France, Greece, Italy, Uruguay and Spain for around 700 sheep and goat breeders.

The second approach is based on interviews about farmer's practices **to identify paragon of livestock farming system.** The interviews focus on farm features, breeding practices, and farmers' choice of traits to improve farm genetics. Based on the diversity of the case studies (10 different types of systems/intensification and different breeds), we will explore how farmer choice can be linked to various socio-technical systems and positively enable increased sustainability of agriculture.

Course teachers:

Alexandros Theodoris (Lab. of Animal Production Economics, Aristotle University of Thessaloniki, Greece)

Marion Sautier, Vincent Thénard (INRAE, France)

Stéphanie Coppin (Idele, France)

3 Multi-actor roundtables

3.1 Reference to DOA and Plan for the Exploitation and Dissemination of Results

As mentioned in DOA and in the Plan for the Exploitation and Dissemination of Results (D8.2 [§3.1.3]), 10 round tables in 10 different countries are to be organized during the SMARTER project in order to reach all relevant stakeholders to disseminate in the 10 countries and exchange on the project to get feedback on it.

The roundtables are part of the task 8.3 "Dissemination and training for stakeholders" led by S-ICAR.

The DOA mentioned organization of stakeholder meetings in 10 local countries (Switzerland, UK, Spain, France, Italy, Ireland, Hungary, Greece, Romania and Norway). The format of the meetings should be multi-actor round-tables and training, the audience size expected is 50 to 100 attendees.

The multi-actor roundtables are intended to constitute a highlight in SMARTER results dissemination and exploitation.

3.2 Deviation from DOA

As the Romanian partner BUAS did not participate in any of the ongoing project activities, the General Assembly of SMARTER decided to transfer the organization of the BUAS round table from Romania to Uruguay. The transfer will be done with the corresponding budget to INIA-UY after the acceptation by REA.

3.3 Main features of the roundtables

The organization of the roundtables and their main features were discussed during two meetings:

- a work meeting on 10th of December 2020
- a wrap-up meeting on 14th of January 2021

The partners responsible for the organization of the roundtables are:

Country	partner
France	RACES DE FRANCE
Greece	FRIZARTA
Hungary	UNIDEB
Ireland	TEAGASC
Italy	ARAL
Norway	NSG
Spain	UNILEON
Switzerland	FIBL
UK	SRUC
Uruguay	INIA-UY

Scheduling the round tables

The roundtables are planned to be held at 2/3 of the project timeline in order (i) to have enough practical results to present, (ii) to have enough time to consider feedback and set up proposed amendments to the WP.

The roundtables will be done in local language to reach the maximum of local stakeholders and farmers.

The agenda

The agenda and organization can be flexible to adapt to the local situations. The content does not need to be the same whatever the country. It may depend on the country, its commitment in SMARTER and the targeted messages adapted to the country.

However, the agenda should comprise:

- A common set of presentations that would be done in each country
  - Focused on main objectives, main (practical) results.
  - A presentation from each WP will be provided (for use as it is or for possible personalization, up to the country to translate). For that target, each WP will prepare a set of 10-12 slides (before summer 2021) for this common part.
- A custom part adapted to the needs of each country (traits-oriented, evaluation-oriented, breeding goals-oriented …). This is an opportunity to go further in the discussion and to interact with the stakeholders.
- It was suggested to give a time/space to WP7 to take advantage of the meeting and the presence of stakeholders to get replies from simple surveys in relation to WP7.

During the preparatory meeting of the roundtables, it was stressed that it was important to give a time for discussions and exchanges and not to have only plenary sessions. This implies that, to foster interactions, physical meetings are preferred to virtual meeting.

When and how long?

The best period would be between September 2021 and May 2022 (allowing enough results and letting time to get feedback and possibly integrate them in SMARTER). Nevertheless, as physical meetings are promoted, the period could be extended a little bit, according to the pandemic situation. However, due to delays the period was changed from April – December 2022 to give all the organizers enough time to prepare for each round table.

1 or 2 days are suggested. 2 days would be better if possible to foster interactions.

Audience

All the domestic stakeholders should be invited: end-users, professional federations, breeding organizations, inter-professional organizations, sheep and goat farmers, training people, scientists, wider society (specialized newspapers, consumers …). On the whole 50-100 people are expected.

The SMARTER roundtable might be coupled with an existing event.

Which reporting?

- A report of the roundtables must be sent back to EAAP and ICAR (in charge of the deliverable) and feedback or suggestions must also be sent back to WP leaders accordingly, so that they can study the propositions and take them into account.
- It would be an added-value to produce a short video and/or interviews of farmers or other stakeholders on the interest of SMARTER for them.

Which resources?

The presentations will be mainly done by domestic resources from SMARTER project. But in some cases, foreign people from the WPs should be requested for specific presentations. Such commitment must be thought over long before to facilitate the organization.

Organizing partners must think about the translation of the set of slides produced by the WP.

Number of meetings and broadcasting?

The "norm" is one meeting in presence.

Alternatives were proposed:

- A joint meeting across country (e.g. Norway & UK).
- Several meetings to "get closer" to the farmers in their region (e.g. Switzerland)
- Hybrid: broadcast round tables through Facebook or YouTube channel. This sounds a nice idea, technically possible, but the risk that people just connect and don't interact must be managed. It could suit for plenary presentations, but not for interactions.

3.4 Planned organization of the roundtables

3.4.1 France (RACES DE FRANCE)

Date and location: 5-6 April 2022, Vendée (OS Moutons Vendéens).

Agenda

The choice of the place makes possible to organize the meeting in several parts:

- A global presentation of the main practical results of the different WP (common presentation proposed to all countries).
- A focus on results from French partners with comparisons with other countries, with emphasis on the resilience and efficiency traits (traits studied in experimental farms, traits or proxies collected in the on-farm protocol and that can be used in the breeding programs), the main results regarding the under-utilized breeds, the tools proposed for a better harmonization and cooperation at an international level (basically, the interest of across country evaluation through the results of the case-studies), the work on the balanced breeding goals.
- A debate with stakeholders about how they receive these results and theirs expectations in terms of further research, dissemination to end-users and practical use by the industry and the breeding organizations. A focus will be put on the evolution of the selection objectives for adaptation in agro-ecological transition. The participation of many stakeholders to the meeting should be an opportunity to complete some lively questionnaire related to WP7.
- Visits of one (or two) farm(s) (Goat or (and) Meat Sheep) in the "Central West" Area. The farms will be chosen among those involved in on-farm protocol (WP1 and WP2). The discussion with participants could focus on the valorization of results for the farmer and the breed organization and their use in the near future.

- Interviews of stakeholders (especially farmers) will be conducted and will part of the deliverable.

List of invited organization

- -Sheep and Goat Breeding Organizations and partners (AI centers, breeding centers / stations, recording organizations).
- -Breeders who participate to the on-farm phenotyping protocol (WP1 ad WP2).
- Sheep and Goat inter-professional organizations: Interbev ovins, France Brebis Laitière and Anicap.
- -Stakeholders of the sheep and goat industry: specialized labor unions (FNO for sheep, FNEC for goats), cooperatives, merchants, slaughterhouse.
- -France Génétique Elevage (FGE) [Inter-professional organization for French genetics for cattle, sheep and goat industries] and the stakeholders of the breeding programs.
- -Partners of Research and Development Institutes (INRAE, IDELE) involved in Smarter issues.
- -Agricultural training institutions and farming high schools involved in sheep and goat breeding.
- -Specialized newspaper.
- Organic breeders.

About 60 participants (at least) are expected.

Strategies and organization:

1 sole roundtable, not backed to an existing event.

2 days

3.4.2 Uruguay (INIA)

Date and place: Uruguay: 21-22/4/22 in Tacuarembó (400 km north of Montevideo). It will be held in conjunction with the RUMIAR project seminar, which has activities in conjunction with SMARTER and GrassToGas (ERA-NET SusAN).

Agenda

Genomic selection and the possibility of including new traits in the breeding goals (e.g. feed intake, residual feed intake, methane emissions, resistance against nematodes), selection for robustness. New collaborative selection schemes within (wool and doble purpose breeds) and between breeds (mainly in meat breeds) including or not informative nucleus.

Attendees:

- Uruguayan Wool Secretariat (SUL), proposed as stakeholder and co-organization of the round table.
- Asociación Rural del Uruguay (ARU) – (Unión of breeders' associations).

- Breeders Association of: Corriedale, Merino Australiano, Texel, Merino Dohne, Border Leicester, Merilin, Romney Marsh, Il de de France, Ideal (Polwarth), Highlander, Poll Dorset, Hampshire Down.
- Central Lanera Uruguaya (CLU).
- Federación Uruguaya de Centros Regionales de Experimentación Agropecuaria (FUCREA).
- Instituto Plan Agropecuario.
- Facultad de Agronomía – Universidad de la República del Uruguay (UdelaR).
- Facultad de Veterinaria – UdelaR.
- Institut Pasteur de Montevideo.
- Instituto Nacional de Tecnología Agropecuaria (INTA-Argentina).

3.4.3 Hungary (University of Debrecen)

Date and place: April 22nd 2022 in a one-day meeting at the University of Debrecen. No other events organized jointly.

Agenda: Genetic diversity, breeding objectives, efficiency.

Planned number of attendees: 71 attendees

Attendees: Local farmers, Industry representatives, PhD Students, Sheep cooperatives, Students and researchers.

3.4.4 Spain (UNILEON)

Date and Place: 6-8 June 2022, Valladolid, Foro Ovino. The SMARTER session was run on day 8 of the Foro Ovino.

Agenda: The round table of the SMARTER project in Spain was held during the *XXIV Foro Nacional del Ovino* (National Sheep Forum). The *Foro Nacional del Ovino* is an annual meeting in which different issues in the small ruminant sector are addressed and which concentrates on a 3-day meeting on those issues of most interest in the Spanish sheep industry. This Forum is a point of exchanging experiences and ideas with more than 300 attendees, including researchers, companies in the sector, technicians and farmers, meet.

Attendees: Over 300 due to the fact that the session was run within a larger meeting. Many different Spanish organisations were present at the event.

3.4.5 Greece (Frizarta Association)

Date and place: 25 June 2022 in Agrinio city

Agenda: importance of resilience traits and breeding objectives.

Attendee: Invited organizations and Cooperatives: National Livestock Breeding Centers, Frizarta sheep Cooperative, Chios sheep Cooperative, Lesvos sheep Cooperative, ACOP, Kalavryta Cooperative.

Planned number of attendees: 50.

Number of breeders: 35.

3.4.6 Ireland (Teagasc)

Date and Place: 12th July 2022 in Thurles

Attendees: 80 + people present.

Agenda:

- Opening with Dr. Noirin McHugh, Teagasc explaining the **SMARTER EU** project
- International speaker, Mr Sam Boon of AHDB on **'Improving the genetic merit of the national flock'**
- Sheep Ireland's Dr. Thierry Pabiou on '**Evaluation Demystifier'**

Dr. Noirin McHugh, Teagasc on 'Reducing GHG and Increasing Efficiency, a win-win for the Sheep industry'

3.4.7 Switzerland (FIBL)

Date and place: Took place on the 17th November 2022 at Fam. Hofstetter, Widmen, 6162 Entlebuch. We are still waiting for the feedback of the event from the organisers.

Agenda

10:00 Welcome and objectives of SAMARTER project (SW and BB).

10:05 Time slot for Stakeholders for short presentations/statements if desired.

10:20 Swiss related results obtained in SMARTER (BB and SW).

10:40 Discussion/Roundtable: What do these results mean for future work in Switzerland?

11:00 Other SMARTER contents, either presented by Beat or connected via Zoom and translated on Site

11:20 Discussion – what can we learn/use from other countries/partners?

11:30 Talk on harmonization of breeding values (BB, WP6)

11:40 Room for discussion/roundtable

12:00 Lunch and social get-together

13:30 Farm and cheese dairy tour

15:00 Closing with Apéro on farm

Attendees:

Around 80:

- -Swiss goat breeding association (SZZV).
- -Swiss sheep breeding association (SSZV).
- -Swiss dairy sheep breeding cooperation (SMG).
- -Association of professional sheep farmers (Berufsschäfer).
- -Swiss Sheep (Schafe Schweiz).
- -Federal Health and Extension Service (BGK).
- -Eventually Federal office for Agriculture and Federal Food safety and Veterinary office.

3.4.8 UK (SRUC)

Date and place: Will be on the 7th December 2022 in Edinburgh (UK)

Agenda: Day 1: host country or international scientist talks about results from SMARTER (45 mins) + round table discussions in break-out rooms on key topics For UK and Ireland this is likely to be: 1 International evaluation, 2. Genomics, 3. Feed efficiency

Day 2: Farmer-led reporting from break-out groups from day 1 & discussion (45 mins) + host country or international speakers.

We plan to use pre-recorded international talks that can be translated and these can then go onto the SMARTER website afterwards. The scientists will be present to answer any questions during these international meetings. As UK & Ireland share the same language then it is easy for us to do this. We will invite speakers from the SMARTER consortium to talk and if necessary we will get the talks translated.

Planned number of attendees: About 60 participants.

Attendees:

- Sheep and goat breeding organizations and partners (AI centers, breeding centers / stations, recording organizations).
- Breeders who participate to the on-farm phenotyping protocol (WP1 ad WP2).
- Sheep and Goat inter-professional organizations: Interbev ovins, France Brebis Laitière and Anicap.
- Stakeholders of the sheep and goat industry: specialized labor unions (FNO for sheep, FNEC for goats), cooperatives, merchants, slaughterhouse.
- Agricultural training institutions and farming high schools involved in sheep and goat breeding.
- Specialized newspaper.

3.4.9 Italy (ARAL)

Date and place: Will take place 6-10 February 2023 in Padenghe sul Garda (Brescia, Italy) in the Seminario SATA Bovini.

Agenda:

- Results related to CHEESR project of AssoNaPa.
- ARAL Caprine Technical Consulting Seminar over 2 days
- Results of WP7 (survey) as well as emphasis on WP6.

Planned number of attendees: Breeders organizations, research institutes, advice service companies. From 30 to 60 participants.

The round table will be organized in one day, linked with no across country organization.

3.4.10 Norway (NSG)

Date and place: Will take place 17-19 February 2023.

Agenda: Still TBD.

Planned number of attendees: Breeders organizations, research institutes, advice service companies. From 30 to 60 participants.

4 Deviations or delays/Contingency plan

The summer school was scheduled in April 2022; however, as planned, in December 2021, it was decided to postpone the summer school to Spring 2023, for two main reasons:

1) the COVID situation;

2) the 8-months extension request.

Within December 2022, a final decision will be taken: a) to organize the summer school in presence, if the COVID situation allows it; b) to organize the summer school on-line or hybrid.

Within the same deadline, it will be decided the location as well as the logistic details.

Regarding the ten National Round Tables (NRT) to be organized in ten countries, the same reasons given for the summer school may also be recalled

The COVID pandemic did not allow their organization, obliging the local organizers to delay to 2022.

The new proposed calendar is the following one, pending of having sufficiently good condition of displacement due to the COVID.

1. France: 5-6/4/22: Vendée (OS Moutons Vendéens)
2. Uruguay: 21-22/4/22 in Tacuarembó (400 km north of Montevideo)
3. Hungary: 22/4/22
4. Spain: 6-8/6/22
5. Greece: 25/6/22
6. Ireland: 12/7/22
7. Switzerland – 17/11/22

Round Tables still to come :

- UK – 7/12/22
- Italy – 6-10/02/23
- Norway – 16-19/02/23

The partner originally indicated in the Agreement for organizing a round table in Romania (Universitatea de stiinte agricole si medicina veterinara a Banatului, BUAS) has been replaced by INIA Uruguay since we did not receive replies from the partner although contacted many times. The proposal of replacing the Rumanian partner by a Uruguayan one was ratified by the SMARTER ExCom.

In case of impossibility of organizing the NRT due to the still persisting condition of the pandemic, some remote meetings are proposed to be organized always respecting the composition of the participants and the program as detailed in the Grant Agreement of the Project.