



Cattle Breeding for Low Methane Emissions: From Farm Measurement to Genetic Progress

Zaragoza (Spain) • 24 - 28 February 2025



Objective

Like all economic activities, livestock production is a source of greenhouse gases (GHG) that contribute to global warming. Of the GHGs produced by livestock production, methane from enteric fermentation in ruminants is the most important, accounting for about 30% of total global methane emissions.

Several methane mitigation strategies are currently under intense research. Genetic selection is one of the most promising tools based on the existing genetic diversity in ruminants. Genetic improvement to reduce methane emissions is based on identifying and breeding cattle with low methane emissions. This strategy could be easily integrated into routine farm management, is cost effective and provides long-term results. However, this type of breeding programme is difficult to implement. Identifying low-emitting cows requires measuring methane from a large number of individuals on different farms using expensive and complex equipment; developing, standardising and curating large data sets; creating genetic models to estimate breeding values for methane traits; and practically incorporating these new traits into a breeding programme on a national scale.

Some countries have already started to record individual methane emissions from cows, but there is a lot of room for improvement. Furthermore, as global warming is a planetary issue, it is necessary that more countries include methane in their cattle breeding programmes in order to have a meaningful international response to this issue.

The aim of this course is to teach the process required to include methane as a trait in breeding programmes.



At the end of the course, participants will:

- know the advantages and disadvantages of different methane measuring devices on farm;
- understand how to screen and manipulate raw datasets provided by methane measuring devices;
- be able to create genetic models and estimate genetic parameters for methane traits;
- be aware of different proxies to estimate methane emissions;
- understand the concept of breeding programmes and how to implement methane traits;
- know about different breeding programmes implementing methane traits.

Organisation

The course is jointly organised by the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM), through the Mediterranean Agronomic Institute of Zaragoza (CIHEAM Zaragoza), the Horizon Europe Re-Livestock project "Facilitating Innovations for Resilient Livestock Farming Systems" (GA No. 101059609), the Basque Institute for Agricultural Research and Development (NEIKER), and the Global Research Alliance (GRA).

The course will be held at CIHEAM Zaragoza over a period of one week, from 24 to 28 February 2025, in morning and afternoon sessions. It will also be held online through live sessions transmitted from CIHEAM Zaragoza.

The course will be given by well-qualified lecturers from universities and research centres and international organisations, from different countries. Birgit Gredler-Grandl from Wageningen University and Research (WUR) and Oscar González-Recio from the National Institute for Agricultural and Food Research and Technology of the Spanish National Research Council (INIA-CSIC) are the scientific coordinators. The programme will be delivered in English.

The course requires personal work and interaction among participants and with lecturers. The international characteristics of the course favour the exchange of experiences and points of view. Lectures will be complemented with practical work, case studies, and technical trips. The practical work will focus on improving programming skills to manipulate raw datasets from methane measuring devices and the estimation of genetic parameters and the creation of genetics models.

Programme

0. Welcome to participants, message from organisers. Programme explanation (1 hour)

1. Overview of global GHG emissions and genetics developments for methane mitigation in ruminants (1 hour)

2. Methane measurement techniques (9 hours)

- 2.1. Laser devices
- 2.2. Non-Dispersive Infra-Red devices (different types of sniffers)
- 2.3. GreenFeed
- 2.4. Respiration chambers
- 2.5. Portable accumulation chambers and others
- 2.6. Discussion session: Common problems and solutions for measuring methane in field
- 2.7. Field trips: Demonstration of different devices for methane measurement
 - 2.7.1. Fraisoro Eskola, Zizurkil
 - 2.7.2. NEIKER, Vitoria-Gasteiz

3. Manipulation and processing raw data from sniffers and GreenFeed and translation into different methane trait definitions (4 hours)

- 3.1. Definition of methane phenotypes in cattle (methane yield, methane concentration, methane production, methane intensity, residual methane)
- 3.2. Practical work: Editing raw sniffer data (quality control, definitions of traits)
- 3.3. Practical work: Editing raw GreenFeed data (quality control, definitions of traits)

4. Estimation of genetic parameters and genetic models for methane emission (5.5 hours)

- 4.1. Introduction to genetic models (variance component and breeding value estimation)
- 4.2. Practical work: Development of a genetic model for methane emission in cattle
 - 4.2.1. Introduction to software
 - 4.2.2. Setting parameter files and running program
 - 4.2.3. Interpretation of results
- 4.3. Discussion session

5. Overview of proxies to estimate methane emission (4 hours)

- 5.1. Mid infrared spectra, MIR
 - 5.1.1. Introduction to MIR
 - 5.1.2. How to predict methane emission based on MIR (set-up, validation studies, methods, important considerations)
- 5.2. Microbiome
 - 5.2.1. The role of the microbiome in methane production
 - 5.2.2. Approach to predict methane from rumen microbial community
 - 5.2.3. Aggregated variables as proxies for rumen microbiota in Spain

6. Incorporation of methane traits in breeding programmes (4.5 hours)

- 6.1. Introduction to breeding programmes
- 6.2. Case studies:
 - 6.2.1. Spain
 - 6.2.2. The Netherlands
 - 6.2.3. New Zealand
 - 6.2.4. Canada
 - 6.2.5. Australia
- 6.3. Discussion session

7. Summary and final remarks (1 hour)

Guest lecturers

García, Aser – NEIKER, Vitoria-Gasteiz, (Spain)
Goiri, Idoia – NEIKER, Vitoria-Gasteiz, (Spain)
González-Recio, Oscar – INIA-CSIC, Madrid (Spain)
Gredler-Grandl, Birgit – WUR, Wageningen (The Netherlands)
Manzanilla-Pech, Coralia – WUR, Wageningen (The Netherlands)
Montgomery, Hayden – Global Methane Hub, Montevideo (Uruguay)
Pryce, Jennie – La Trobe Univ., Melbourne (Australia)
Vanlierde, Amelie – CRA-W, Gembloux (Belgium)
Yáñez-Ruiz, David – CSIC-EEZ, Granada (Spain)

Admission

The course is designed for professionals with a university degree, and oriented towards researchers, academic and decision-makers from public and private institutions, PhD students and technical advisors involved in the development and implementation of cattle breeding and genetic programmes.

- 30 places will be available for face-to-face participation with access to lectures, practical sessions, case studies and technical trips (30 hours).
- 10 places will be available for online participation with access to lectures, practical sessions, and case studies (24 hours).

Knowledge of English will be valued in the selection of candidates, as it will be the working language of the course.

Registration

- Candidates may apply online at the following address: <https://admission.iamz.ciheam.org/en/>
- Applications must include the curriculum vitae and a copy of the support documents most related to the subject of the course.
- The deadline for the submission of applications is **15 November 2024**. If places are still available after this date, applications will remain open until 15 December 2024 only for candidates who are not applying for financial support and do not require a visa.
- Applications from candidates requiring authorisation to attend the course may be accepted provisionally.
- This course is funded by the European Union so there are no registration fees but participants must cover their own travel and accommodation costs.

Support to candidates

Candidates from CIHEAM and GRA member countries and other European countries may apply, during the registration process, for financial support covering totally or partially the cost of travel and accommodation.

Candidates from other countries who require financial support should apply directly to other national or international institutions.

Insurance

It is compulsory for participants on site to have medical insurance valid for Spain. Proof of insurance cover must be given at the beginning of the course. Those who so wish may participate in a collective insurance policy taken out by the Organisation, upon payment of the stipulated sum.

Contact:

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<https://www.iamz.ciheam.org/education/advanced-courses/>

