GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

GRA FLAGSHIP PROJECT

Title: Technical guidelines to develop feed additives to reduce enteric methane

Leaders: André Bannink (NL) and David R. Yáñez-Ruiz (ES)

GRA Council Champions:

1. *Netherlands (tbc)*
2. *Spain (tbc)*
3. *Ireland (tbc)*
4. *New Zealand (tbc)*
5. *UK (tbc)*

Countries involved: So far, researchers from the following countries have confirmed interest: Netherland, Spain, Ireland, New Zealand, UK, France, Canada, USA, Denmark, Colombia, Finland, Mexico, Chile, Belgium, Brasil and many others can potentially join. The foundation of the flagship is the *Feed and Nutrition Network* of the LRG. The idea of the project was presented at the last FNN workshop (23rd November 2021) and many colleagues showed high interest.

Start date and project length: September 2022 and 2 years

Brief description of project:

Background

There is increasing interest and need in cutting methane emissions worldwide, enteric methane being one of the main targets. The modulation of rumen fermentation through feeding practices represent the main strategy to reduce methane emissions from ruminants and in particular, the use of additives has shown great potential. However, despite extensive research conducted over the last decades, the number of additives that deliver substantial reduction is very limited and have not reached the market yet. A very recent assessment coordinated by the GRA and other international initiatives (Hegarty et al., 2021) has shown that the global livestock industries have a very limited suite of emerging feed additives suitable for enteric methane suppression and many constraints have been identified: a poor understating of the efficacy, lack of knowledge on the modes of action, uncertainty about persistency of effects and insufficient research in practical applicability in different grazing systems.

Objectives

The **overall aim** of this Flagship project is to facilitate the development and use of feed additives to reduce enteric methane emissions in the livestock sectors. The specific objectives are:

1. Provide technical guidelines and protocols on good practices to test and develop feed additives of different nature (chemically synthesised, macro and micro algae, essential oils, saponins, tannins, antimicrobial peptides, probiotics…). The technical guidelines will describe good practices to conduct trials *in vitro* and *in vivo* to target 3 main elements:
    a. **Efficacy** and **delivery** options across different livestock production systems, especially in relation to the dietary management (pasture, high/low forage, by-products…)
    b. Uncover the **mode of action** of the active molecules and

c. Adequate assessment of the **persistency** of the effects

2. Facilitate the registration process of feed additives and accounting for reduction in emissions in GHG inventories

Methods

The project will first discuss and arrange the potential contributions from different partners and other on-going projects across countries during the FNN meeting at the next GGAA (5th June, 2022). The steps following the FNN meeting are:

- Recruit postdoc with expertise in ruminant nutrition / GHG emissions
- Establish structure of the guidelines: chapters, sections…
- Allocate responsibilities for coordination of each section to participating partners
- Data gathering, processing and discussion
- Prepare and deliver the technical guidelines on good practices, including in vitro/in vivo protocols, statistical design, regulatory aspects, etc … and a position scientific paper on feed additives

Key partners and existing resources:

The foundation of the flagship is the Feed and Nutrition Network (FNN) of the LRG, in which many institutions have expertise in testing and developing feed additives of different nature (3NOP, algae, essential oils, saponins, legumes). FNN members have published in the last years scientific papers and technical documents in relation to GHG emissions and means of mitigation through feeding mmnagement. The following institutions have showed interest in participating WUR (NL), CSIC-INIA (ES), Teagasc (IRE), AU (DK), Embrapa (BR), INIA (CL), UCD-UP (US), QUB-SRUC-UREAD (UK), AgResearch (NZ), INRAe (France), Agro (CO), LCL Network (Argentina, Uruguay, Chile, Colombia, Ecuador, Peru, Mexico, France and Spain).

The project co-leader (David Yanez-Ruiz) coordinates the recently awarded Horizon-Europe project '*Re-Livestock*' (Facilitating Innovations for Resilient Livestock Farming Systems), a 12 M EUR project with 37 partners (2022-2027). Re-Livestock can provide resources for the coordination of the flagship project together with data from the testing of newly developed additives. Other on-going projects that can provide resources or data are: H2020 '*MASTER*: Microbiome Applications for Sustainable food systems through Technologies and EnteRprise' or national projects like '*METH-ABATE*' in Ireland.

Benefits and outcome from Flagship project:

- Initiating and stimulating a globally active network of countries actively investigating and evaluating feed additives, that pursue to make best use of the potential that feed additives offer to mitigate GHG emissions.
- Standardization of experimental methods as well as awareness of potential limitations due to methodology.
- Reach out to regional and global organisations pursuing use / implementation of feed additives.
- Stimulating exchange between LRG research networks: Feed and Nutrition, Rumen Microbial Genomics and Manure Management.
- Improved capabilities of scientific community and feed industry to develop feed additives, especially in countries with technical limitations.

- Increased applicability of feed additives and go beyond the additives that are better positioned at the moment, by including other compounds that need further development (i.e. saponins, tannins)
- Increased tools and criteria to facilitate the process of accreditation/market approval
- Facilitated accounting for reduction in emissions in GHG inventories at regional or national levels

Further Resourcing needs:

The flagship project will need to enrol a postdoctoral fellow who will gather and process the technical information from all contributing partners.

Resourcing mechanisms:

In addition to the projects mentioned above, other resourcing mechanisms can be explored, such as COST Action networking (European Cooperation in Science and Technology) which can now include non-EU countries and future ERA-NET SusAn calls. The project could also benefit from CLIFF-GRADS fellowships to support short-term (6 month) involvement of PhD students from developing countries (round 5 of CLIF-GRADS to open in mid-2022).

Linkages:

The flagship project through the FNN has strong linkages with other research networks (RMG and MNN), and ongoing (H2020, Horizon Europe, FACCE-JPI) and future research initiatives (i.e. Fontagro call on Sustainability and Resilience). In addition, linkages can be established with global organisations such as FAO and IPCC on how to account for efficacy of feed additives at various scales.