Interventions to reduce enteric methane emissions in early life of cattle

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CASE partner: Zero Emissions Livestock Project (ZELP)

Project description:
Several interventions have been proposed for mitigating greenhouse gas (GHG) emissions arising from livestock production. In particular, there are some methane inhibitors (e.g., 3-nitrooxypropanol (3-NOP), active compounds from seaweeds, tannins) that possess potential reductions to carbon footprints when fed to cattle. A recent study has shown that some anti-methanogen compounds administrated at early stages of dairy calves' life reduced the calves methane emissions by 11.6% while the 3-NOP was administered, but also had a lasting effect, reducing the emissions by 17.5% after one year of ceasing 3-NOP administration. However, the previous study was undertaken under dairy conditions where calves were feed either milk replacer or a total mixed ration (TMR), and subsequent research has shown that the 3-NOP anti-methanogen properties are less effective under pasture-based conditions. These anti-methanogen interventions may affect the microorganism populations inhabiting the rumen and could have a mid- or long-term effect in reducing methane emissions. Moreover, if such interventions are combined with additional mitigation strategies later in life, e.g., wearable devices to oxidise the methane exhaled into carbon dioxide (CO2) and water vapour (H2O) their joint effect might produce substantial reductions in GHG emissions from the livestock sector.

Therefore, the objective of this project is to assess whether anti-methanogen compounds administrated within the first two weeks of life to calves reduce methane emissions at different life stages, i.e., calf, growing steer or finishing stage and under different feedings regimes: e.g., until weaning, silage feeding, and under grazing conditions. Moreover, this project aims to assess the potential of agritech tools like ZELP wearables, capable of oxidising methane exhaled into CO2 and H2O, with a particular emphasis on its potential to reduce methane emissions of young stock. All these interventions will be assessed in a comprehensive way with regard to their impact on the carbon footprint at a system level through Life Cycle Assessment (LCA).

The PhD thesis will involve the following Tasks to assess:
T1: The short-term effect of anti-methanogen technologies on calves' early life enteric methane emissions.
T2: The mid/long-term effect of the early anti-methanogen intervention on calves' enteric methane emissions while grazing or consuming silage
T3: How the intervention affects the potential usage of Zelp wearables as a second methane emissions inhibitor
T4: To undertake a LCA of the aforementioned conditions for comparative purposes and identification of optimal mitigation strategies

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.