Cutting GHGs from cattle

Paul Smith, Walsh Scholar of the Year, Animal & Grassland Research and Innovation Programme.

Paul's PhD project is investigating the link between the composition of the rumen microbiome, feed efficiency and methane output in beef cattle. Paul is supervised by Sinéad Waters, David Kenny and Alan Kelly (UCD).

The microbial ecosystem (microbiome) inhabiting the rumen provides ruminant livestock with the ability to convert forage into high-quality sources of dairy and meat protein for human consumption. However, one group of rumen microbes, known as methanogens, are responsible for nearly 60 % of Irish agricultural-related greenhouse gas (GHG) emissions through the production of methane. As a GHG, methane is 28 times more potent to the environment than carbon dioxide, with ruminant-derived methane originating as a natural by-product of feed degradation in the rumen. Therefore, decreasing the volume of methane produced by the Irish livestock industry will be key to adhering to the 2030 EU target of a 30 % reduction in Irish GHGs.

Understanding the links

Potential exists to breed low-methane-emitting cattle. However, the effectiveness of selecting more sustainable livestock will be dependent on an increased understanding of the microbiological mechanisms underpinning methane production. As a result, Paul's project aims to better understand the link between the composition of the rumen microbiome and feed efficiency, methane output and the host genome in beef cattle. To achieve the objectives of the project, GreenFeed systems have been installed at the Irish Cattle Breeding Federation (ICBF) progeny test centre in Tully (Kildare) to estimate methane output from cattle. These units, the first of their kind in Ireland, allow for large-scale measurements of methane output from individual animals. At the end of a three-week methane measurement period, a sample of rumen fluid is obtained from each animal to facilitate examination of the relationship between the composition of the rumen microbiome and the aforementioned phenotypes. With the use of next-generation sequencing, rumen fluid samples are currently undergoing molecular analysis in an effort to determine the relationship between the composition of the rumen microbiome, feed efficiency and methane output. An additional element of this project will be to investigate the potential genetic influence of the host (cow) on the rumen microbiome, feed efficiency and methane output.

Developing future strategies

Findings from this project will provide a greater knowledge to develop future methane mitigation strategies via breeding and dietary supplementation. In addition, this work has the potential to identify animals with a greater genetic propensity to efficiently utilise feed, while minimising their impact on the environment, assisting Ireland in achieving a 30 % reduction in national GHG emissions.

Acknowledgements

Paul's PhD forms part of the EU-funded international projects RumenPredict (funded by the Department of Agriculture, Food and the Marine (DAFM) through the FACCE ERA-GAS programme) and MASTER (EU H2020), with Teagasc researchers, along with colleagues in UCD and the ICBF, participating in both projects.

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