A joint initiative of

Australian Government
Department of Agriculture, Fisheries and Forestry

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MEAT & LIVESTOCK AUSTRALIA

Reducing Emissions from Livestock Research Program

Novel strategies for enteric methane abatement

Production of methane from hydrogen in the rumen is nature's way of disposing of the hydrogen produced by microbial fermentation of feed. Otherwise, accumulation of hydrogen in the rumen would slow down digestion.

This project aims to decrease the amount of hydrogen available for methane production by reducing hydrogen production through elimination of rumen protozoa (Figure 1), and by increasing hydrogen usage in non-methane products, particularly in converting nitrate to ammonia.

Protozoa control

- In partnership with the Queensland Institute of Medical Research (QIMR) in Brisbane, this project seeks to discover effective anti-protozoal compounds (or classes of compounds) that can be developed for commercialisation.
- Elimination of rumen protozoa in sheep consistently increases protein availability, wool growth and pre-weaning liveweight gain.
- Elimination of rumen protozoa (Figure 1) in sheep often reduces methane production, but few results area available for cattle.

Nitrate reduction

- Nitrate is a natural compound often found in new growth of pastures.
- Nitrate is a potent methane inhibitor (Figure 2) but too much nitrate, too quickly, can be harmful to the sheep as a result of accumulation of an intermediate compound (nitrite).
- This project aims to discover how sheep adapt to nitrate in the diet, and how nitrate affects methane production and rumen processes.

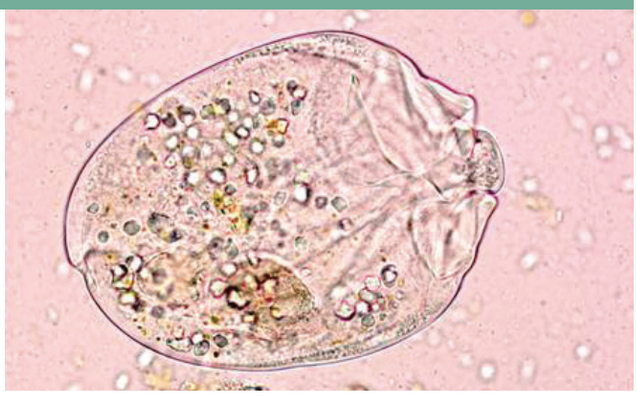

Figure 1: Rumen protozoa are much larger than bacteria and act as predators in the rumen ecosystem, liberating hydrogen that is then used in methane production.

The program

The Reducing Emissions from Livestock Research Program is a national collaborative program focused on developing practical on-farm options for significantly reducing emissions from livestock while simultaneously increasing productivity. The research will develop more accurate data on emissions from sheep and cattle and the levels of mitigation achieved using a range of strategies.

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Project objective

Evaluate two novel methane mitigation technologies for their potential to significantly reduce enteric methane emissions from cattle.

Progress

Protozoal Control

- Representatives from over seven families of bioactive compounds have been screened for their effectiveness in controlling rumen protozoa.
- Preparations are being made to determine comparative growth and methane production of cattle once protozoa have been removed.
- By completion of this project we hope to have proved the value of protozoal control (called defaunation) to boost cattle production while reducing methane emissions.
- We also expect to have candidate compounds ready to enter the commercialisation pipeline with a major pharmaceutical company. Engagement with potential partners has begun.

Nitrate Reduction

- Nitrate supplements consistently reduce the rate of methane production in sheep.
- This mitigation is extremely rapid, and within three hours of ingestion, nitrate reduction is complete.
- Redirecting hydrogen into nitrate reduction changes the fermentation pattern in the rumen, encouraging hydrogen yielding reactions.
- Progressive acclimation of sheep to dietary nitrate does not appear as critical as folklore suggests, at least when nitrate is provided as calcium nitrate supplied at up to 0.3% nitrate-N in the diet. This aspect of safety and acclimation requires further assessment.

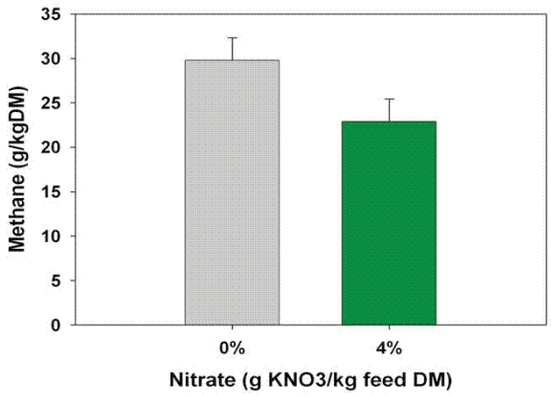

Figure 2: Initial result showing reduction in methane emission by sheep when supplemented with four per cent potassium nitrate in the diet.

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