SeaHealthUCD

**Issue 35: September, 2020: This e-bulletin is aimed at personnel in fisheries and aquaculture, at fish packers, processors, distributors, retailers and finally, consumers.**

# Algae:-the methane connection

Reducing methane production by ruminant animals will have a significant impact on meeting greenhouse gas (GHG) emission targets in many countries. Ireland is no exception in view of the number of our ruminant animals, especially cattle for beef and dairy foods. Enteric methane is a by-product from anaerobic fermentation of feed organic matter by microbes in the rumen. This produces carbon dioxide and hydrogen which lead to the formation of methane in a reduction pathway via methanogenic bacteria in the rumen (Morgavi *et al*., 2010). Algae have been used in livestock feeds for centuries but it is only recently that the potential of red seaweed *Asparagopsis* to reduce methane production in ruminants has been recognised both *in-vitro* and *in-vivo* trials (Paul *et al*., 2006; Machado *et al*., 2016; Li *et al*., 2018; Chagas *et al*., 2019).

## Australian/New Zealand study

This landmark study was conducted by Kinley *et al*., (2020) and involved including freeze-dried red seaweed *Asparagopsis taxiformis* in the feed (high grain diet) of steers at 0.00, 0.05, 0.10, and 0.20% of feed organic matter. Freeze-drying was necessary to prevent loss of the volatile anti-methanogenic compound bromoform ($CHBr_3$). Methane emissions were measured in respiration chambers every 14 days during the 90-day duration of the study. Other factors monitored were steer weight, feed intake, rumen function, and post-slaughter residue and sensory analysis of the beef. Methane emission in steers receiving 0.10 and 0.20% *Asparagopsis* decreased by up to 40 and 98%, respectively over the duration of the trial. None of the other test parameters were influenced by algal inclusion. In addition, bromoform was not detected in meat, fat, organs, or faeces of the steers.

## Commercial potential

Commercialisation on a large scale would be difficult in view of the quantities of *Asparagopsis taxiformis* needed. Most seaweeds have a dry matter content of only 6-12% and this translates to large quantities of fresh seaweed. Freeze-drying is also necessary which is a dual process and is expensive. The Australian/New Zealand authors of the study suggest the way forward includes improvements in *Asparagopsis* quality through optimal cultivation and processing. This would further reduce effective inclusion level, exposure to excess minerals, and optimize the supply chain. The Hawaiian start-up company Symbrosia (link in reference list) is addressing this issue head-on. Their models suggest that circa 10% daily growth rate is needed to make *Asparagopsis* production economically viable. Early trials indicate that a sheep needs 6g of *Asparagopsis* a day to reduce its methane emissions and a dairy cow circa 100g. Researchers in Penn State University (link in reference list) express reservations i.e. if seaweed feed supplement is a viable option to make a difference globally, the scale of production would be immense. With nearly 1.5 billion head of cattle in the world, harvesting enough wild seaweed to add to their feed would be impossible.

## Applications in Ireland

The scale issues outlined above would also apply in Ireland; in addition, ingestion of *Asparagopsis* would be difficult as Irish cattle are grass fed for most of the year. A project in Bantry Marine Research Station Ltd (BMRS) (link in reference list) is testing anti-methanogenic compounds from Irish seaweeds on rumen fluid followed by trials on cultivation techniques of seaweed species of interest. Research on reducing methane emission in beef and dairy cattle has been ongoing in Teagasc-Grange (link in reference list) and also in UCD (Smith *et al*., 2020) for a number of years. More recently the multi-partner METH-ABATE (funded by DAFM) and SeaSolutions (funded by EU ERA-NET) projects have come on-stream. The former is studying the development and validation of novel technologies to reduce methane emissions from Irish agricultural systems. The latter is using seaweeds and seaweed-ingredients to reduce enteric methane emissions from pasture-based sheep, cattle and dairy cows.

**Way forward**: (i) identify additional (to bromoform) methane reducing components in seaweeds; (ii) understand how they interrupt methane production by rumen methanogens; (iii) seek natural sources of these compounds (seaweeds and elsewhere) in quantities that are economic and impactful.

***References***


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*The previous 34 issues of Seahealth-ucd can be viewed at: https://www.ucd.ie/foodandhealth/newsandevents/seahealthucd/*



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