Connecting the animal genome, gastrointestinal microbiomes and nutrition to improve digestion efficiency and the environmental impacts of ruminant livestock

RuminOmics e-Newsletter

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Project holds 4 regional workshops

The project held 4 workshops across Europe in Warsaw (Poland), Budapest (Hungary), Lodi (Italy) and Edinburgh (Scotland, UK). The workshops covered the following topics.

- Global view of environmental impact of ruminant livestock production.
- Regional Livestock Sectors, breeding industry and goals.
- Nutrition, efficiency and emissions.
- Rumen Microbial Ecology.
- Does the host animal control the activity and composition of its gut microbes?
- Tools for rapid analysis of animal phenotypes and the rumen microbiome.
- Field-scale study of rumen function, efficiency and emissions in dairy cows 'The 1000 cow study'.

The presentations from each workshop are available from the project website: http://www.ruminomics.eu/index.php/project_workshops/

In general the outputs from the project were highly valued and in particular the need to link emissions with nutrition, the rumen microbiome and genetics. Also the fact that the data from the project, particularly in relation to the 1000 cow study, would be freely made available post project for further analysis was

particularly appreciated. There was potential for future collaboration between countries in the further use of this data.

The questions discussed at the workshops and the responses were...

Will it be possible to eliminate rumen methane emissions without influencing rumen efficiency?

- Although past research indicated that methanogenic micro-organisms in the rumen have developed to sequester methane to stop the build of hydrogen there was increasing evidence that blocking this pathway may not result in reduced efficiency of digestion. This could lead to new types of additives.

The twin cow studies showed unexpectedly that the composition of the microbiome varied between identical twins before the digesta transfer. Does this mean that there is no link between the animal (genetics) and the microbiome?

- The link may be complex since in both the twin cow and reindeer cow studies there were indications post digesta transfer that the animal can influence individual groups of micro organisms but not others.
- More research is needed in this area with more animals per treatment and with longer times post digesta transfer. Also work needs to examine the microbiome of the whole of the tract.
- It may be that factors in early life have a big impact on subsequent composition of the microbiome. More research is needed in this area.

Proxies are needed for key criteria since in any practical situation many of the techniques used in RuminOmics are unsuitable/ difficult/expensive to be used on farm.

- The microbial composition of samples using a relatively simple technique of taking swabs from the mouth during rumination showed a close relationship (apart from protozoa) with that in the rumen. This technique could be widely used as a proxy and indeed in the Budapest workshop a company intended to extend the technique for use in describing phenotypes.
- Measurement of intake on farm is extremely difficult if not impossible. This was key to estimate efficiency. There are indications from the project that using Near Infra red Spectroscopy (NIRS) on faeces could provide a useful proxy.
- More work needs to be done to evaluate these proxies in the field.

Are feed additives a useful tool to reduce methane or is breeding a more sustainable long-term strategy?

- Many feed additive mitigation strategies although they reduce methane do not increase production or improve efficiency.

- Some strategies are banned in Europe or could have safety issues.
- Unless additives increase profit or supported by policy/ legislation/market led then they will not be adopted.

If breeding is likely to be the most sustainable strategy can we select for methane and what are the consequences of this? - Should we select for methane?

- The results from the 1000 cow study showed considerable variation between cows in both methane and efficiency.
- There was no relationship between methane output and efficiency. So selection for methane is unlikely to improve efficiency.
- Meta analysis of nutrition/ digestion studies show that between animals, low methane emitters may be less efficient in terms of digestion.
- These data indicate that selection for methane may not be the best strategy whilst it may be better to select for efficiency (with the proviso that there was a good proxy for estimating intake on farm).

What are the policy implications of the research?

- In Eastern Europe GHG targets exceed current levels of emissions due to the massive decline in animal numbers post Soviet era and the major constraint of low herd size to adoption of new technologies. Policy aims were to improve herd structure and increase efficiency and these measures will reduce emissions per unit of production.
- All workshops stressed that technologies to reduce methane would not be adopted unless they could be shown to increase profit or through legislation or market pressure. Animal breeding provided the most feasible option especially if projects such as RuminOmics provided improved selection methods to reduce methane and GHG.
- The end of the milk quota system will likely see the expansion of the milk industry. In some countries environment legislation for other pollutants (water directives etc) would limit the increase but in others considerable increases in milk production were foreseen. This could reduce the impact of the progress being made in reducing methane per unit of product.