Reducing greenhouse gases is now a worldwide vision

Getting to the tiniest carbon footprint

Altering feeding and breeding to reduce methane production is a hot topic and the focus of on-going projects around the world. New findings and goal driven international projects are leading the way.

by **Amy Ryan**

With a lofty goal of reducing its greenhouse gas (GHG) emissions by 20 percent by the year 2020, the European Union (EU) is investing in multiple research projects to measure methane production and reducing its emission through genetic selection and feeding. Current research efforts in the Netherlands by Yvette de Haas, Senior Scientist and Project Leader with Wageningen UR Livestock Research in the Netherlands, have focused on the improvement of resource efficiency through genetics.

"Improved efficiency of livestock is of major importance for both the farmer, because he can then reduce his feed costs, and for the urban sector, because the environmental impact is less with lower emitting animals," say de Haas. "Ultimately, the aim is that in a couple of years, Dutch farmers can select sires that produce more efficient offspring."

She continues to say that genetic improvement of livestock is a cost-effective technology, producing permanent and cumulative changes in performance, and should therefore go hand in hand with daily nutritional improvements.

There are a couple of projects in which de Haas is involved, namely measuring individual methane of dairy cows and assessment of the methane emission of the individual dairy cows at farm level.

De Haas says the purpose of the first project is to measure individual methane emissions of dairy cows in either a concentrate dispenser or a milking robot with a Fourier Transformed Infrared (FTIR) gas analyzer.

"There are not many in the world measuring individual methane emissions on a large scale and this project will enable us to decide on the optimal

measuring period to get an indicative trait that predicts daily methane emission of a cow," says de Haas. "In addition, it will unravel the genetic background of this trait and link it to possible indicator traits that are recorded on national basis, like fatty acids in milk, MIR-profiles, feed intake or milk production."

While this project and its results present exciting opportunities, de Haas states there are some disadvantages to this measurement. Cows are measured while eating concentrates, they are only measured for a couple of short visits per day and they are not measured during lying time and rumination. These disadvantages present the need for de Haas' second project.

"In this project we will design, test and validate an assessment method to determine the methane emission of individual dairy cattle at farm house level, which will allow us to determine the methane emission between a large number of cows," she says. "It aims at developing a proof of principle under practical conditions where individual methane emissions will be measured during a long period each day."

When asked about her findings thus far, de Haas cites some of the first results shared earlier this summer at the Greenhouse Gases & Animal Agriculture Conference in Dublin, Ireland. Specifically, she says that research has shown using a portable FTIR measuring unit in a milking robot to measure individual cow CH4 emissions gave realistic values and ranges. Furthermore, the FTIR instrument combined with milking robots or concentrate dispensers may be useful in the future to generate large scale data for genetic evaluation of CH4 (methane) production in dairy cattle.

RuminOmics

Another on-going research project regarding the genetic selection of cattle for lower methane production is RuminOmics. This four-year, 7.7 million euro European Union-funded project, is spearheaded by Professor John Wallace, a microbial biochemist with the Rowett Institute of Nutrition and Health at the University of Aberdeen in Scotland.

Wallace will be working with 11 partners from the UK, Sweden, Finland, France and Italy to gather data.

"I primarily work on RuminOmics and other projects sponsored by the Scottish government on characterizing ruminal microbial communities in Scottish livestock," says Wallace. "We believe by understanding the microbiology and the control that the host animal exerts over its gut bugs, we may be able to select for and breed animals with low methane emissions."

He adds that the RuminOmics project was developed to measure methane and associated parameters in an unprecedentedly large animal set (1,400 dairy cows in all). State-of-the-art technologies will be used to determine the genetic basis of gut microbiology and methane emissions.

According to the most recent RuminOmics E-Newletter, outputs of the project include:
• relate animal genome to microbiome, feed efficiency, and methane emissions
• determine host-microbe interactions in genetically identical and genetically diverse animals
• relate changes in the nutrient supply to the ruminant with the composition and function of the ruminal microbiome, as assessed by methane and N emissions
• provide tools and bioinformatics for rapid analysis of phenotypes, microbiomes
• create a public metagenomics database
• effectively disseminate project technologies and results.

When asked about discoveries to date, Wallace says, "There is a correlation between methane emissions and the size of the community of archaea in the rumen, which means that analysis of rumen digesta samples for archaea can be used as a proxy for estimating methane emissions from individual animals. Furthermore, numbers of archaea in digesta samples taken at slaughter were a good proxy for samples from live animals. These samples can be used to predict how much methane the animal produced when it was alive, which enables the

genetic analysis of a large number of animals."

METHAGENE

While there are multiple projects like those mentioned earlier going on worldwide, tying all this information together in one package and offering comprehensive results is a challenge.

For this reason, de Haas initiated METHAGENE, a project she says will develop an innovative, interdisciplinary, collaborative EU network of experts and interested parties to promote communication between animal breeders, nutritionists, animal physiologists, rumen microbiologists, bio-informaticians and environmental engineers. She chairs the Animal Selection Genetics Genomics Network that brings together scientists worldwide working in this field of research.

"This network is established as it is a relatively new field with many people working in it and we want to bring scientists together and create synergy," says de Haas. "In order to utilize genetic selection as mitigation strategy, it's highly desirable to combine these datasets of many countries to produce a European database of 10,000-15,000 animals."

She adds that combining the data already collected under different protocols requires intensive discussions among scientists. More importantly, the developed agreed protocols in a multi-disciplinary approach will allow existing and future data from different countries and collection methods to be combined.

Reduced GHG

"Climate change is a growing international concern and it is well established that the release of GHG is a contributing factor," says de Haas. "Projects like those referenced earlier are increasing in importance to producers as methane can be considered as a loss/waste/inefficiency, and to reduce a possible future carbon tax."

Wallace concludes with the simple statement, "A successful inhibition through nutrition and genetics will result in greater feed efficiency, which means dollars and cents to dairy producers worldwide." |