Methane Emission Reduction in Dairy Animals

Methane emission reduction also helps in improving milk production

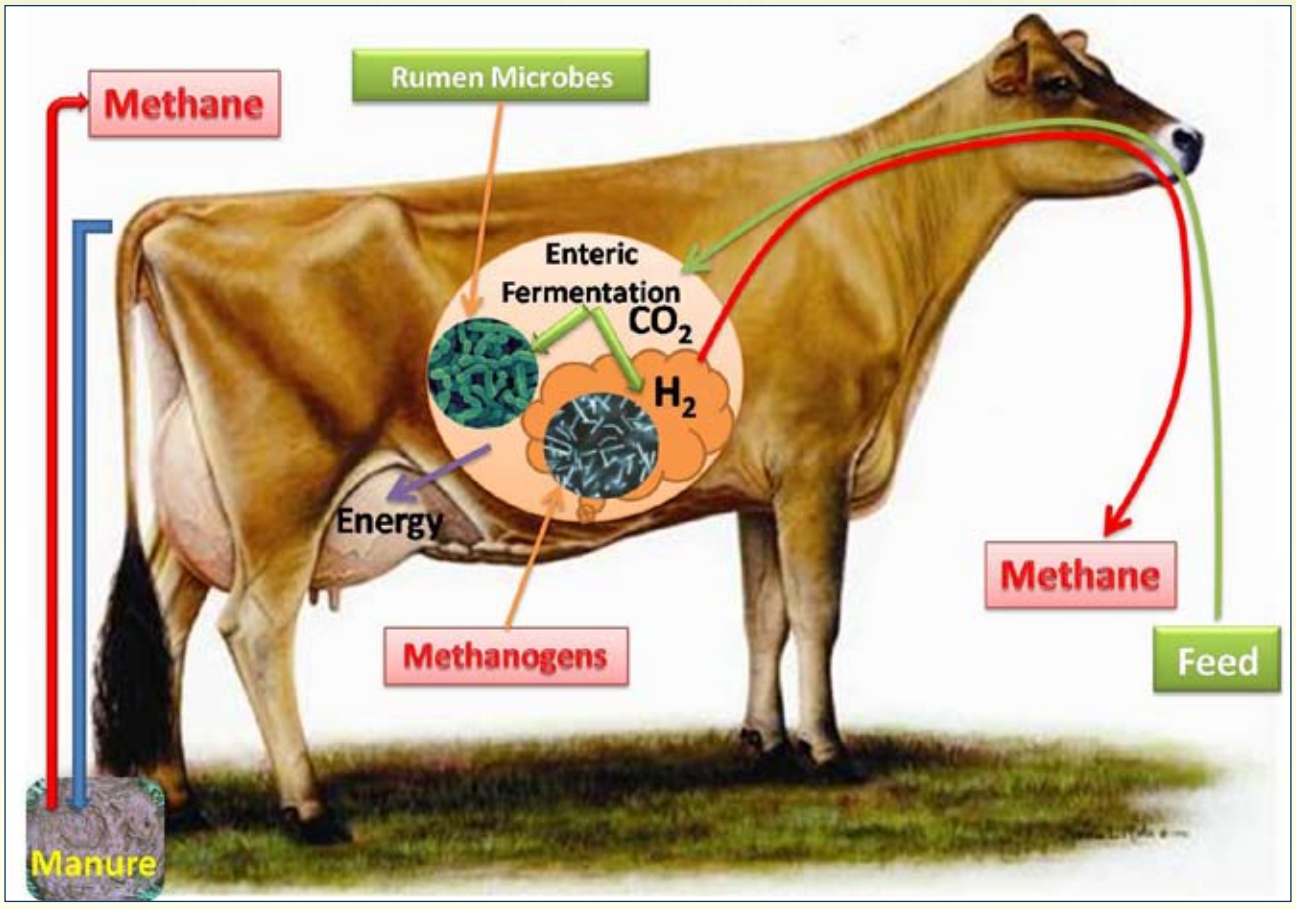
National Dairy Development Board
Anand

Introduction

Global climate change has become a major cause of concern due to increase in atmospheric concentrations of greenhouse gases (GHGs). Climate change affects animal production and well-being, especially due to increase in ambient temperature. Methane is a potent GHG, emitted as a result of enteric fermentation of feed by ruminants. Enteric fermentation is responsible for about half of the total methane emission in India. Ruminant animals loose 4-12 per cent of gross energy intake in the form of methane, which is not only detrimental to environment but also results in energy loss to animals.

Methane production in ruminants

Ruminant livestock have a unique digestive system comprising of four stomach, which includes the rumen, reticulum, omasum and abomasum. The rumen is the first and largest compartment amounting to 80 per cent of the total stomach volume where microbes such as bacteria, protozoa and fungi break down and ferment the feed material into products like volatile fatty acids (VFAs), microbial protein, carbon dioxide and methane.



Amongst the VFAs, acetate and butyrate are methanogenic and spare hydrogen during formation, while propionate is glucogenic in nature and utilises hydrogen. More acetate and butyrate production leads to production of more hydrogen and carbon dioxide, the main substrates for methane production. Under anaerobic conditions of rumen, methanogenic bacteria utilise hydrogen and carbon dioxide to form enteric methane, emitted mainly through belching.

Measurement of methane by SF_6 tracer technique

Methane emission estimation by SF_6 tracer technique under field conditions

- Sulfur hexafluoride (SF_6) tracer technique is an internationally accepted technique for measurement of methane emission from ruminants under natural conditions of feeding and management.
- In this technique, a small permeation tube containing SF_6 is placed in the rumen of an animal.
- Thereafter, the breath samples are collected daily for four consecutive days in canisters and brought to the laboratory for methane and SF_6 analysis.
- Methane and SF_6 concentrations are determined by gas chromatography. Methane emission rate is calculated as the product of the permeation tube emission rate and the ratio of CH_4 to SF_6 concentration in the breath sample.

Feeding balanced ration for reducing methane emission

In India, most of the farmers follow traditional methods of feeding which is generally imbalanced in terms of energy, protein and minerals. Animals fed on imbalanced ration produce more methane per unit of milk due to lower microbial protein synthesis and higher acetate production.

In view of this, NDDB has initiated studies on measurement of methane emission reduction through ration balancing in different agro-climatic regions, where farmers are advised by the village based trained local resource persons (LRP) to balance the ration of animals with locally available feed resources, using computer software developed by NDDB.

Balanced diet alters rumen fermentation pattern towards lower acetate, butyrate and higher propionate production. This results in higher microbial protein yield and reduced methane production. High propionate and microbial protein synthesis provides energy and protein for milk production in lactating ruminants.

Field trials conducted by NDDB indicate that, ration balancing has potential of improving efficiency of milk production, microbial protein synthesis while reducing methane emission per kg milk yield.

Methane emission reduction through balanced feeding under field conditions

Benefits of reducing methane emission through ration balancing

- Better utilisation of locally available feed resources in the ration of animals
- Efficient utilisation of dietary energy and proteins by ruminants
- Improved efficiency of microbial protein synthesis
- Reduction in loss of gross energy intake
- A part of dietary energy lost as methane is channelised for productive purpose
- Improved productivity of dairy animals
- Reduction in the GHG emissions by dairy animals

For more information, please contact: Animal Nutrition Group, NDDB, Anand.