PROJECT 2013-2018

MITIGATION OF ENTERIC METHANE PRODUCTION FROM DAIRY COWS AND IMPACT ON MANURE EMISSIONS: FILLING KNOWLEDGE GAPS

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Number of students trained (MSc, PhD, Post-Doc):	3
TOTAL BUDGET	$491,243

INVESTMENT PARTNERS

Agriculture and Agri-Food Canada

DAIRY FARMERS OF CANADA

OBJECTIVE:

Methane production from ruminant animals represents a loss of productive energy and contributes to greenhouse gas (GHG) emissions The objectives were to investigate specific dietary strategies (type of forage, lipid supplementation, interaction between forages and lipid addition) on methane emissions from enteric fermentation and manure storage of lactating dairy cows. The dietary mitigation strategies were also assessed for their economic impact on Canadian dairy farms.

KEY OUTCOMES:

- Ruminal methane production can be reduced by feeding supplemental linseed oil with the extent of reduction depending on the level of supplementation and the source of forage of the basal diet.
- The addition of 4% linseed oil to a red-clover silage-based diet decreased methane energy losses by 11% of gross energy intake without adversely affecting animal performance.
- When 4% linseed oil was added to a corn silage-based diet, methane energy losses decreased by 23% of gross energy intake, but dry matter intake, milk production and milk fat yield were depressed.
- Methane and carbon dioxide from anaerobic manure storage increased by 15% and 11%, respectively, when cows were fed linseed oil-supplemented diets versus non-supplemented diets regardless the source of silage.
- Compared with diets based on alfalfa silage, diets based on corn or small grain silages (i.e. barley silage) resulted in the production of higher levels of ruminal propionic acid over acetic acid with a concomitant reduction in methane.
- Compared with red-clover silage-based diets, feeding corn silage-based diets increased anaerobic manure methane emissions (L of CH_4/kg of volatile solids) by 54% and manure carbon dioxide emissions (L of CO_2/kg of volatile solids) by 47%.
- Enteric methane production (as a % of gross energy intake) was lower (-7%) for cows fed brown midrib corn silage compared to cows fed regular corn silage.
- Compared to manure from cows fed regular corn silage-based diets, manure from cows fed brown midrib corn silage-based (lower lignin) diets emitted 18% more methane (L of CH_4/kg of volatile solids) and 25% more carbon dioxide (L of CO_2/kg of volatile solids) during the 17-week anaerobic storage period.
- Data generated from Dairy Research Cluster 1 and 2 revealed that CH_4 energy losses (Ym; as a % of gross energy intake) average 5.79%, which is lower than the default value of 6.5% recommended by IPCC (Intergovernmental Panel on Climate Change, 2006; Tier 2 methodology) for the calculation of inventories of enteric methane emissions from dairy cows. Data generated from Dr. Benchaar's laboratory were requested by IPCC and are the basis for the new revised factor for the new IPCC methodology that will be released in 2019. This new factor will be used by Environment and Climate Change Canada in their methodology to improve accuracy of calculation of National Inventories of enteric methane emissions from dairy cattle in Canada.
- The whole farm model N-CyCLES was improved for methane prediction for dairy cows using new information and equation generated from this project on diet composition.
- The concentrations in milk of six specific fatty acids were correlated with methane emissions suggesting that it may be possible to predict a cow's methane emissions based on the fatty acid profile in her milk.

LINK TO KTT TOOLS

VIDEO:

Reducing Greenhouse Gases in Dairy Production
agr.gc.ca/fra/science-et-innovation/centres-de-recherche-et-collections-sur-l-agriculture-et-l-agroalimentaire/quebec/centre-de-recherche-et-de-developpement-de-sherbrooke/reduire-les-gaz-a-effet-de-serre-dans-la-production-laitiere/?id=1431710540033