Best management practices for lowering greenhouse gases from pastoral farming

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The major greenhouse gases (GHG) associated with animal production are methane and nitrous oxides however cultivation also releases large amounts of soil carbon into the atmosphere as carbon dioxide. These gases are responsible for climate change, especially global warming but also extreme weather conditions. Over the past 200 years, atmospheric concentrations of carbon dioxide, methane and nitrous oxides have risen dramatically in response to burning oil and coal and use of nitrogenous fertilizers to increase agricultural production. Many nations have agreed that the release of carbon dioxide, methane, nitrous oxides and others such as chlorofluorocarbons (CFCs) from refrigerants need to be reduced to slow down the rate of global warming. Some nations, including Canada, have made a commitment to lower emissions to 1990 levels by about 2010. This is the Kyoto protocol.

Reducing emissions requires an inventory of GHG to be measured, and calculated for 1990. Canadians produce a lot of GHG, due to extensive livestock farming, transport and industry – burning oil and natural gas. If emissions are expressed on a carbon dioxide basis the average emissions per person is about 22 tonnes, and methane accounts for 13% of this. Much of the methane comes from ruminants, especially cattle, and it represents a significant loss of feed energy – about 6% of dietary energy when methane is belched by ruminants.

Good farming practice will lower greenhouse gas (GHG) emissions from livestock systems Producers need to minimize GHG production per unit of product, so efficient use of feed for production by selecting good quality diets and high producing animals will help. Every calf born needs to survive and grow, otherwise the cow has spent a year achieving nothing; eating feed, belching methane all for nothing! Taking care of manure and effluent and careful use of fertilizer nitrogen (nitrous oxides) will protect the environment and lower waste. This can also lower nitrous oxide emissions, nitrogen leaching to rivers and ground water and ensure that more of the fertilizer is used to grow feed through improved efficiency, profitability and waste. Cultivation and farming practices need to be developed so that these emissions are lowered. Most of the recommendations are similar to “good farming practice” and promote efficient use of feeds and high performance animals.

Methane gas belched from the mouth contains about 10% of feed metabolisable energy. Methane losses occur in young calves when they eat forage and increase to 200-500 g/day in adult beef and dairy cattle. Methane comes from hydrogen produced by bacteria that digest fibre in the rumen. Research to reduce methane production should increase the energy for animal production.

Nitrous oxide is a potent greenhouse gas that has 13 times as much global warming potential as methane (on a weight basis). It comes from urine, faeces,

nitrogen fertiliser, especially under waterlogged conditions. Typical emissions per annum are 0.1-2.0 kg/ha.

Carbon dioxide is not normally included in calculations of emissions from agriculture because production is normally balanced by plant uptake. However, land use change does effect carbon emissions that may become a liability. For example cultivating grazing lands will increase emissions as soil carbon content is lost. Converting grazing lands to forests will lower emissions as carbon is sequestered in trees.

Reducing GHG on farm

1. *High producing animals*. GHG emissions associated with maintenance costs will be a smaller component of emissions/unit production in high producers than low producers. Select animals with a high feed conversion efficiency.
   Future options may provide significant reductions in methane providing they can be achieved without increasing production costs. Selection of lower methane producing animals (typically 60-80% of "average" producers) and removal of high producers (120-130% of average) may also improve feed conversion efficiency.

2. *Feed good quality diets*. Less methane is produced from each kg DM from legumes than grasses. Production is also increased so maintenance costs are lowered/unit production.

3. *Good animal management* will lower methane by maximising production/feed eaten. For example a dead calf represents zero animal production from a cow producing methane for one year. In the sheep industry, twins are preferable to singles.

4. Good pasture management. More methane (and less production) comes from stalky grass than vegetative leaf. Improved pastures need to be well managed.

5. Give slow release *Monensin®* especially with grain feeding. Monensin® will increase feed conversion efficiency with TMR and reduce the risk of bloat from forages. It also lowers methane production/unit feed eaten.

6. Feeding *high proportions of grain* in the diet can lower methane production/unit feed eaten and per unit of product. However grain production has a very high GHG cost from soil carbon losses (3-4 tonne/ha/cultivation), carbon emissions from fuel consumption, drying, fertiliser, tractor manufacture and transport. Methane will be lowered at the expense of other greenhouse gases.

7. Use *fertilizer* on the basis of need rather than a routine operation. Take soil tests to ensure appropriate timing and extent of application. Global positioning technology and satellite imaging enable strategic application within a paddock on the basis of need. Use legumes to fix nitrogen where possible.

8. *Balance rations* to minimise excess production of urinary urea and total nitrogen in excreta. Nitrogen in urine and faeces is responsible for the majority of nitrous oxide release from pastures.

9. *Drain soils* prone to water logging and avoid grazing very wet soils. Nitrous oxide release is very high from oxygen starved soils and this is most common in very wet situations. Minimising treading damage will also maintain pasture growth and quality.

10. *Take care of effluent*. Either return to pasture or capture methane from storage facilities for heating of electricity generation.

These options are little more than good farm practice and can be applied with little change to normal management. If researchers and producers could view GHG mitigation as environmentally sustainable farming with potential benefits for feed conversion into product, everybody would benefit from improved practices.

Snippets: The average dairy cow produces enough methane in one year to run a car for 1000 km. You could do a lot of traveling from a whole herd!

Nitrous oxide emissions from pasture average about 1.5 kg/ha/year. It is also known as laughing gas and all the N_2O from a paddock over one year would give 3 hours of great happiness, but collecting it would be time consuming.
It is also called “nitrous” – used in drag racing