Reducing GHG emissions through GREENHOUSE AND PASTURE MANAGEMENT

Greenhouse gases (GHG) contribute to global warming. Agriculture, with approximately 10 per cent of the total emissions, produces less GHG than many other sectors of the economy, such as transportation and industry. However, agricultural activities still remain a significant source of GHG, therefore we have to explore the possibilities of reducing emissions. Greenhouse gases are responsible for more than half of the nitrous oxide (N\textsubscript{2}O) emissions, a third of methane (CH\textsubscript{4}) emissions and a small quantity of carbon dioxide (CO\textsubscript{2}).

Cattle operations can participate in the reduction of GHG emissions through their grassland and pastures management practices. The results would be agricultural production that is more efficient and more respectful of the environment.

N\textsubscript{2}O, a greenhouse gas with a warming potential 310 times more powerful than CO\textsubscript{2}

Nitrogen is found in nature in many forms and is constantly modified: it is the cycle of nitrogen. Agricultural activities influence that cycle.

Micro-organisms transform nitrogen found in crop and manure residues, mineral fertilizers and in the soil. These transformations (nitrification and denitrification) release nitrogen into the air. The quantity of N\textsubscript{2}O released by transformations performed by micro-organisms depends on climatic factors, mainly precipitation and evaporation, and on the presence of oxygen and the availability of carbon in the soil.

Nitrogen not used by plants and micro-organisms is also a source of N\textsubscript{2}O. Anaerobic conditions (absence of oxygen) induce the emission of N\textsubscript{2}O.

Agricultural nitrogen lost by leaching (nitrates) and volatilization (ammonia) can end up in watercourses and non agricultural land, which can then emit N\textsubscript{2}O.

To reduce N\textsubscript{2}O emissions, agricultural practices aimed at controlling the accumulation of nitrogen must be adopted:
- Avoid the accumulation of free nitrates
- Avoid the development of anaerobic conditions
- Avoid the leaching of nitrogen into watercourses

Strategies to reduce N\textsubscript{2}O, or nitrogen management

Synchronize the availability of nitrates with plants’ nutritional needs
- Avoid excessive doses of fertilizer and manure by taking into account their composition and concentration and previous crops
- Apply organic and mineral fertilizers in the spring rather than in the fall
- Reduce the input of organic and mineral fertilizers

Reduce the risk of anaerobic condition in the soil
- Ensure proper soil drainage
- Reduce and avoid soil compaction
- Have adequate surface drainage (e.g. levelling of the ground)
- Install underground drainage (if applicable)

Increase grassland and pasture productivity
- Improve yield to use nitrogen adequately
- Restore permanent grasslands
- Avoid overgrazing weakened plants
**CH₄, a fermentation gas**

Ruminants’ digestion and the fermentation of liquid manure are the biggest producers of methane gas. These are two conditions where the decomposition of organic matter is performed in the absence of oxygen.

To reduce CH₄ emissions by the digestive system, grasslands and pastures should provide cattle with high quality forage (highly digestible).

**Grasslands and pastures: very useful to capture CO₂**

Even though agricultural activities contribute to CO₂ emissions, they primarily allow for the capturing of carbon. Cultivated plants and trees convert CO₂ into vegetal matter. Maintaining and even increasing organic matter content can be ensured by planting a permanent vegetal cover.

Organic matter of the soil constitutes the only sustainable pool of carbon in agricultural ecosystems. This pool is not constant. It evolves according to the quantities of added organic matter (crop residue, manure and others) and those lost in decomposition. The organic matter content of the soil used to capture carbon should be maintained and even increased.

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**GHG in agriculture: facts**

The contribution of agriculture to the Canadian emissions of greenhouse gases (GHG) is estimated at 10 per cent. The GHG from farm sources originate mainly from microbial activities: ruminant digestion, manure and agricultural soil. These gases include: nitrous oxide (N₂O), methane (CH₄) and carbon dioxide (CO₂).

<table>
<thead>
<tr>
<th>Gas</th>
<th>Warming potential</th>
<th>Agricultural contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂</td>
<td>1</td>
<td>&lt;1 per cent</td>
</tr>
<tr>
<td>CH₄</td>
<td>21</td>
<td>38 per cent</td>
</tr>
<tr>
<td>N₂O</td>
<td>310</td>
<td>61 per cent</td>
</tr>
</tbody>
</table>

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**Strategies to reduce CH₄**

**Improve the quality of forages**
- Manage pastures using rotational grazing
- Maintain 30 per cent of legumea in grassland and pastures
- Avoid overgrazing
- Harvest at earlier stages of development

**Reduce the risk of anaerobic conditions in the soil.**

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**Strategies to reduce CO₂ in the atmosphere**

**Reduce the consumption of fossil fuels**

**Encourage the addition of organic matter in the soil**
- Increase the percentage of the farming operation’s acreage in perennial crops
- Increase crop yields (good drainage, nutrient management, adequate choice of species and mixes according to climate and soil, etc.)

**Increase the carbon pool**
- Plant windbreaks
- Plant trees, bushes and other perennial crops on fragile soil

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To try the greenhouse gas calculator for beef farm operations, contact the Fédération des producteurs de bovins du Québec.

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