SOIL CONSERVATION COUNCIL OF CANADA
CONSEIL DE CONSERVATION DES SOLS CANADA

Global Warming and Agriculture

Methane

In this, the fifth in a series of information sheets aimed at discussing global warming and its relationship with agriculture in Canada, we'll look at methane (CH_4). Specifically, we'll explore the role methane plays in the global warming scenario and the affect agriculture can have on methane levels.

Methane - what is it?

Although existing at low concentrations compared to $C0_2$ [2 parts per million by volume (ppmv) compared to 270 ppmv], methane is a comparatively powerful greenhouse gas. It has 21 times the warming effect of the same amount of carbon dioxide, and is second only to carbon dioxide in its potential to cause future warming of the earth.

Most agriculturally produced emissions come from plant material. When plant material decomposes in the presence of oxygen, carbon is emitted in the form of CO_2. If oxygen is absent CH_4 is emitted. Although CO_2 and CH_4 are both greenhouse gases, CO_2 is considered less harmful because of CH_4's greater global warming potential.

The highest percentage of CH_4 generated by Canadian Agriculture comes from ruminate animals (i.e. cattle, sheep, goats). These animals have a fore-stomach (rumen) where microbial fermentation partially digests feed material in the absence of oxygen. Five to 10 percent of the C in the feed is released at this point as CH_4. Non-ruminant animals (i.e. pigs, poultry) emit some CH_4, but the amount is negligible in comparison.

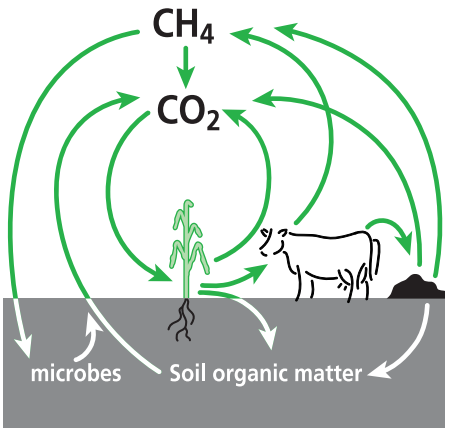
Methane is also emitted from manure. The amount emitted is greatly impacted by methods of storage. When manure decomposes in the presence of oxygen, CO_2 is released. If manure is stockpiled, inadequate aeration within the pile may lead to CH_4 production. As well, higher amounts may be released from manure stored in liquid form because of limited aeration. Once manure is applied to the land, adequate exposure to the air means little additional CH_4 is produced .

Emission from manure accounts for about 20% of the total CH_4 emitted by livestock. Pig manure plays an important role here because of the large number of animals in Canada and because of how the manure is stored.

Our soils play a role in the cycling of methane. When organic materials decompose in submerged or water-laden soils, the reduced oxygen supply causes the release of CH_4. In Canada most soils have enough aeration that they do not produce CH_4.

On the other side of the cycle there are microorganisms in our soil that convert atmospheric CH_4 to CO_2 and thus enable our soils to absorb CH_4. The amount absorbed depends on management practices. For example, CH_4 absorption is higher under grassland than in tilled soils and is suppressed by applying nitrogen fertilizer.

Although CH_4 soil absorption is important on a global scale, the amount absorbed in Canada is small compared to total agricultural emissions.



CO_2 and CH_4 flow in a livestock-based agroecosystem

- Adapted from Janzen et al., 1998

What farmers can do

Although methane is present in the atmosphere at low concentrations, its increasing levels are cause for concern. Natural sources including wetlands, permafrost, termites, oceans, freshwater bodies, wildfires, etc. represent approximately 30% of CH_4 emissions. Human-related activities such as fossil fuel production, animal production, rice cultivation, biomass burning and waste management are the cause of the other 70 % of global emissions. Agriculture accounts for about 70% of human-induced emissions. Domestic livestock account for approximately 30% of the human related methane emissions in North America.

While we have little or no control over the natural sources of methane gas, we can reduce human-induced emissions. Agricultural producers can play a large part in this reduction.

Alter rations to reduce digestion time: The longer feed remains in the rumen the more carbon from the feed is converted to CH_4. Therefore characteristics of the feed can affect emissions. For example CH_4 emissions may be lower from ensiled rather than dried feed, from legume than grass forage and from highly concentrated rather than high roughage diets. Adding grains such as corn, barley or wheat to the diet reduces methane emissions.

Add edible oils: Canola, coconut or other oils added to the diet may inhibit the activity of CH_4 producing bacteria and thus CH_4 production. Though effective, this practice may not always be economical.

Use Ionophores: Ionophores are feed additives that inhibit the formation of CH_4 by rumen bacteria. There is some evidence that rumen bacteria can adapt to given ionophores making it necessary to rotate different ionophores over time.

Improve production efficiency: Any practice that reduces the amount of feed required to produce a unit of product (meat or milk) can also reduce CH_4 emissions.

Manure: Use solid rather than liquid manure handling systems. Oxygen supply is usually better in solid manure thereby encouraging CO_2 production rather than CH_4.

Apply manure to the land as soon as possible: The longer manure is left in feedlots, stockpiles or in slurry tanks or lagoons, the more CH_4 will be emitted. On the other hand oxygen is assessable to manure applied to the land, thus discouraging CH_4 emissions.

Minimize the amount of bedding in manure: Manure with less bedding (i.e. straw) contains less carbon and thus less C that can be converted to CH_4.

Keep storage tanks cool: Insulating or placing storage tanks below ground can slow manure decomposition thus reducing emissions of CH_4.

Aerate manure during composting: Composting reduces the bulk weight of manure to be transported and thus costs associated with manure application. Aeration, either by frequent turning or by providing a ventilation system inside the compost pile, increases the efficiency of the composting process and encourages decomposition to CO_2 rather than to CH_4.

Burn methane as fuel: While not yet widely practiced in Canada, burning methane for fuel offers strong future potential. Some countries take advantage of this and methane from stockpiled manure is regularly collected and burned.

Burning converts the CH_4 to CO_2. As well, burning manure generated CH_4 can replace fossil fuel combustion and thus carbon that is already part of the global carbon cycle is used rather than new carbon from fossil fuel sources.

Sources

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