SOIL CONSERVATION COUNCIL OF CANADA
CONSEIL DE CONSERVATION DES SOLS CANADA

# Global Warming and Agriculture

## *Best Management Practices*

Despite the publicity greenhouse gases (GHGs) have received during the recent political debate over Canada's ratification of the Kyoto Protocol, few farmers have given much thought to reducing the GHGs they produce as a byproduct of their own farming practices. Most farmers, like other members of Canadian society, have not considered what they could personally do to limit their emissions. Fortunately once they start to look into it, farmers will discover that many of the economically driven changes they've already made in their farm practices over the past decade have dramatically reduced the production of on-farm greenhouse gases.

The tremendous advances in livestock nutrition, for example, have been driven by the need to streamline production and improve the bottom line. Yet feeding an animal a well balanced diet for increased productivity also has reduced the amount of methane ruminants produce in their digestive process. Widespread adoption of no-till and direct seeding technology, particularly on the prairies, 40% of all farmland in Saskatchewan alone is now direct seeded, is another very positive development. Here again is an example of change driven by economics that has had a huge impact on GHG emissions. It has dramatically reduced fossil fuel consumption and is turning agricultural soils into carbon sinks. John Bennett, a farmer near Biggar, Saskatchewan, estimates that direct seeding enables his farm alone to store enough carbon in his soils to offset burning half a million litres of fuel a year.

Best Management Practices (BMPs) to reduce greenhouse gas emissions have to be practical as well as economically and environmentally sustainable. Perhaps one day the energy generated by burning methane from manure will be a major source of revenue for feedlots, as feedlot manure does contain half the stored energy of coal. Genetic modifications might one day let corn and wheat plants meet their own nitrogen needs. Unfortunately practices like these are either still in the future or prohibitively expensive. This factsheet will provide an overview of (BMPs) that producers can use to reduce their farm's GHG emissions today. Subsequent factsheets will look at best management practices on a sector by sector basis.

The BMPs that most farmers will be able to utilize fall into one of four broad groups: soil management; soil nutrition management; livestock nutrition and grazing management and improvements in manure management and storage. Some farmers will also be able to incorporate agroforestry practices and plant riparian buffer zones as part of their GHG reduction plan.

## Soil Management BMPs

If all this is new to you, a good general rule of thumb is to remember that many agricultural practices that reduce soil erosion will also reduce greenhouse gas emissions.

### Convert to direct seeding, no-till or other conservation tillage technology

As stated above, this technology not only reduces fossil fuel consumption, it also increases soil organic matter. Building soil organic matter reduces the amount of carbon dioxide ($CO_2$) pumped into the atmosphere through reduced fossil fuel consumption and stores (sequesters) carbon that otherwise would have been emitted. As outlined in the preceding factsheet in this series, Carbon Credits, this technology could play a huge role in Canada's GHG reduction strategy.

### Remove marginal land from cultivation and plant buffer strips

Many farmers have land that, in hindsight, should never have been cultivated for crop production. Although using marginal land for cattle production can be profitable, year after year farmers spend small fortunes trying to squeeze a profit from marginal acres for annual cropping with limited success at best. Planting these marginal or fragile lands to perennial cover will drastically reduce or eliminate the need for inorganic nutrient inputs and tillage. This allows for the build up of soil organic matter and sequesters carbon in the perennial vegetation. Perennial cover can also act as buffer strips and prevent nutrients being lost through surface runoff.

### Crop rotations

Selecting higher yielding varieties that produce a greater biomass is another potential GHG reduction strategy. Higher yields can produce higher $N_2O$ emissions but these may be offset by a greater quantity of carbon returned to the soil as crop residue.

Include legume crops that biologically fix nitrogen (N), such as alfalfa, peas, etc, in your rotation. These crops increase soil organic matter and the residues contain N which can be utilized by the following crop.

Follow these biologically fixating crops with high N-use crops like corn or cereals and include the increased residual biologically fixed N when calculating your fertilizer requirements for the following crop. After all, every pound of N a legume leaves in your soil is one pound of inorganic N you won't need to buy.

### Cover and trap crops

Including a N-scavenging cover crop in the rotation or, interseeding one that is allowed to live over winter, can use residual nitrogen and reduce $N_20$ emissions in the spring. Killing cover crops in the fall with herbicides followed by conservation or reduced tillage in the spring may increase soil organic matter. Waiting until spring before doing a chemical burnoff will also maximize the amount of nutrients available for the subsequent crop and limits the amounts of $N_2O$ loss .

### Residue Management

Maximize crop residues left on the soil surface. This may increase soil carbon, if reduced tillage practices are used. If residues must be incorporated, whenever possible do it in the spring just prior to planting for both soil conservation and to reduce

nutrient loss.

Most soil nutrient management BMPs examine ways to limit nitrous oxide emissions from nitrogen fertilizer and manure. However the formation of $N_2O$ is a natural part of the nitrogen cycle so there are no easy ways to do this. The surest methods are ones that help you meet the crop's N requirements and leave only minimal amounts of residual N at the end of the growing season.

## Soil Nutrient Management BMPs

Soil and manure tests should be done routinely to determine available N. Residual N from cover crops, legumes and manure, should be included when calculating nitrogen requirements to avoid over application. Since $N_2O$ emissions hit their peak during the spring/thaw cycle fall fertilizer and manure applications should be avoided, spring applications are preferable. Ideally fertilizer should be side-banded at seeding or if possible applied throughout the growing season to match application to crop uptake.

## Livestock Management

Improving livestock nutrition is one simple, cost effective way to reduce the production of GHGs generated by livestock. Methane production for example goes up 50% when cattle move from good quality spring pastures to poorer quality pastures in the fall. It's estimated that feeding the wintering cow/calf herd a balanced diet during winter would reduce their $CH_4$ production by 15%.

Reducing dietary protein intake in hog rations can produce major reductions in GHG emissions by swine. Reducing dietary protein intake by 20% will reduce the N excretion by sows by 20 to 30%, which could lead to a significant reduction of the nitrous oxide (N20) and methane emissions when slurry is applied applied to fields. Methane emissions are greater if pigs are fed barley instead of a corn-based diet. Emissions can be reduced in barley-based diets if the dietary protein content is lowered.

### Grazing Management

Improving pasture management and quality is another way to increase profitability, productivity and reduce GHGs. There is a strong relationship between forage quality and methane emissions. Methane emissions increase by nearly 50% as cattle move from the high quality, vegetative, grass forage found in spring pastures to poor quality, more mature pastures in the fall. Adding as little as little as 25% legume to your forages will also consistently produce significant reductions in methane production. Fertilizing tame pastures is still another method to encourage more vegetative growth and improve pasture quality.

### Rotational Grazing

Try to prevent overgrazing. Rotational grazing can help maintain even pasture growth, this reduces weed encroachment and promotes a healthy forage stand. When pasture growth is uneven, cattle target the regrowth which leads to lower pasture productivity causing frustrated animals.

## Manure Management and Storage

The 50% of livestock GHG emissions that come from manure are more problematic. Modifications to storage systems are expensive solutions and only produce moderate emission reductions. The jury is still out on which manure systems are the best for managing GHGs. Currently managing animal nutrition is the best way to manage manure GHG emissions.

Covering manure storage areas or managing pH levels by adding straw limits $N_2O$ and $CH_4$ production. Manure should be incorporated as soon as possible to minimize the nitrogen loss. These practices also keep the neighbours much happier by reducing odours.

In liquid manure management systems the use of covers may reduce methane ($CH_4$) emissions by up to 95%. Switching to bottom loading systems, reducing storage times and keeping pH levels at 4.5 will almost completely eliminate $CH_4$, $C0_2$, and $N_20$ losses from manure.

Timing manure spreading operations also affects GHG emissions. Eliminating or minimizing winter manure spreading reduces the amount of excess N available in the spring when $N_2O$ losses are the greatest.

## Agroforestry BMPs

Shelterbelts promote carbon sequestration and increase crop production. Windbreaks around farm buildings reduce GHGs by significantly decreasing the amounts of farm fossil fuel used to meet farm heating and cooling requirements.

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