SOIL CONSERVATION COUNCIL OF CANADA
CONSEIL DE CONSERVATION DES SOLS CANADA

Global Warming and Agriculture

Best Management Practices for Coarse Grains

If Canada is going to be able to fulfill it's commitment to reduce green house gases (GHGs) all industries are going to be expected to do their part. Environment Canada, based on methods developed by the United Nation's Intergovernmental Panel on Climate Change, has determined that agriculture is responsible for 10% of Canada's greenhouse gas emissions. Fortunately many producers will discover that they've already made changes in their farm practices over the past decade that have dramatically reduced the production of on-farm greenhouse gases.

Best Management Practices (BMPs) to reduce greenhouse gas emissions have to be practical as well as economically and environmentally sustainable. Farming is a risky business at the best of time and any practice which doesn't provide farmers with concrete benefits will not be easily adopted.

Widespread adoption of no-till and direct seeding technology, particularly on the prairies, where 40% of all farmland in Saskatchewan alone is now direct seeded, is a good example. Only 7% of Ontario corn acres are currently planted using no till although these numbers jump to nearly 50% for beans and cereals. This technology has single handedly been responsible for agriculture's transition from an industry that was a net emitter of greenhouse gases into one that now, again on a net basis, removes carbon from the atmosphere.

Farmers have switched to this style of farming for the economics and soil conservation, but no-till/direct seeding also has a huge impact on GHG emissions. It dramatically reduces fossil fuel consumption, removes carbon from the atmosphere and stores it in the soil as organic matter. The experience of Barry Newcombe, a farmer near Cook Sound, Ontario, an hour north of Toronto, provides a good example.

"I got into no till for fuel savings and for soil conservation but it also seems to be a good thing for greenhouse gas reduction." Newcombe says. "We farm some rolling ground that was washing away and I couldn't stand to look at it. Some of the ground is a sandy loam or a loamy sand and would blow like crazy. The corn was being sandblasted in the spring. While those were the main reasons I switched its big advantage has been reducing expenses. Fuel costs, iron costs, labour costs and so on are all way down. We have two 130 hp, two-wheel drive tractors for example. They are old tractors but since we just put 165 hours on them last year, at that rate they will last forever."

If the concept of reducing greenhouse gas emissions is new to you, a good general rule of thumb to remember is that many agricultural practices that will reduce soil erosion will also reduce greenhouse gas emissions. Here are some examples:

Convert to no-till, direct seeding, 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 both 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 our Carbon Credits factsheet, this technology could play a huge role in Canada's GHG reduction strategy.

Remove marginal land from annual crop production and plant buffer strips

Many farmers have land that, in hindsight, should never have been used for agricultural production of coarse grains. Year after year farmers spend small fortunes to try to squeeze a profit from marginal acres with limited success at best. Planting these marginal or fragile lands to perennial cover will eliminate the need for inorganic nutrient inputs and tillage. This allows for the build up of soil organic matter and for sequestering carbon in the perennial vegetation. They 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. Producing higher yields can result in 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 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 is a good greenhouse gas reducing strategy. This can use up residual nitrogen and reduce N_20 emissions in the spring. Killing cover crops in the fall with herbi-

cides followed by conservation or reduced tillage in the spring is another option that 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.

Newcombe now intercrops red clover with his winter wheat to help with his crop rotation and help build up his soil organic matter.

"In late February or early March we go out with the four wheeler and spread ten pounds of red clover on top of the winter wheat," Newcombe explains. "The frost's freezing and thawing action works it into the ground. It's not a perfect catch but after we take off the winter wheat in early August we still get some clover. We burn the clover off late in the fall with glyphosate and 2,4-D and the field goes back into beans or whatever the following year. It helps build up the soil structure and gives us a little bit of nitrogen."

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.

Soil Nutrient Management BMPs

Most soil nutrient management BMPs attempt 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. Reynald Lemke, a researcher with Agriculture and Agrifood Canada in Swift Current, Saskatchewan believes the best approach is to use nitrogen efficiently.

"How do we use nitrogen most efficiently?" Lemke asks, "I think that overall, an across the board reduction in fertilizer use is not the way to go. In fact sometimes making the most effective use of fertilizer could mean using more fertilizer not less. For example if you know that adding four units of fertilizer is going to increase N_2O emissions by this amount but will give you ten times the crop, then I think using it would be reasonable. If we're going to produce crops, and we will, then we want to find ways to grow the most crop for the least N_2O. "

Ideally you want to make sure you have enough N to meet the crop's requirements while leaving only minimal amounts of residual N at the end of the growing season. Soil and manure tests should be done routinely to determine available N. Include residual nitrogen from cover crops, legumes and manure, when calculating nitrogen requirements to avoid over application. For the most accurate results soil tests should be done as close to planting as possible. Since N_2O emissions hit their peak during the spring/thaw cycle fall fertilizer and manure applications should be avoided, spring applications are preferable. Fertilizer should be banded at seeding or if possible applied throughout the growing season to match application to crop uptake.

"We try not to bulk spread fertilizer any more," Newcombe says. "Just a bit of potash on poor places in the fields. One of our goals when we started was to apply fertilizer when we were planting. We could put it in the ground where we wanted it and save ourselves an application cost, six, eight or ten bucks an acre; whatever the fertilizer guys are charging."

Variable rate fertilizer

Since Lemke's research is showing higher N_2O emissions in the wetter, lower slope positions in fields he believes there is potential to manage N_2O emissions by varying the amount of nitrogen applied across the field.

"If you are trying to minimize or constrain N_2O losses then you really want to pay careful attention not to apply fertilizer in excess of crop requirements in areas like the lower slope positions that have high losses," Lemke says. "The best way of dealing with this might be to use specific types of fertilizers, cut back fertilizer rates or use inhibitors in lower slope positions but not on the rest of the field."

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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