SOIL CONSERVATION COUNCIL OF CANADA
CONSEIL DE CONSERVATION DES SOLS CANADA

Global Warming and Agriculture

Best Management Practices for Small Grains

If Canada is going to be able to fulfill its commitment to reduce greenhouse 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 agriculture, especially the small grains sector will easily be able to surpass any emission reductions that currently are being discussed. Many producers will discover that they have already made changes in their farm practices over the past decade that have dramatically reduced the production of on-farm greenhouse gases.

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 a good example. Farmers switch to this style of farming for the economics, 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.

Since nearly half of both small and coarse grain producers in Saskatchewan converted to direct seeding and no till technology in the 1990's agricultural soils have switched from being a source of carbon emissions to being 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 more than half a million litres of fuel a year.

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 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 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 the Carbon Credits factsheet, this technology could play a huge role in Canada's GHG reduction strategy.

Jack Swainson and his family run a small grain farming operation near Red Deer, Alberta in conjunction with a 1500 head capacity feedlot. Swainson is a strong advocate of direct seeding.

"We strongly believe in the concept of zero till in this black soil zone where we usually get lots of moisture," Swainson says. "I've promoted the idea to a lot of people. Last year's drought was rude awakening. It was sad but people now realize that moisture is not a given, even in this area. I think that everyone is starting to get their heads around the idea that we can reduce tillage, there is a lot of interest in it. We do not need to keep the field black. I think that by and large people get their heads around it by watching someone practice no-till across the fence or down the road and then try it out on their own farms."

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 small grains. Planting these marginal or fragile lands to perennial cover will not only get rid of a cash drain by reducing or eliminating the need for inorganic nutrient inputs and tillage it also allows soil to build organic matter and sequester carbon in the perennial vegetation. Perennial forage areas can also act as buffer strips and prevent both surface and ground water borne nutrients from reaching waterways.

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.

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

Follow biologically fixating crops with high N-use crops like corn or cereals and include residual, bio-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.

Tim Nerbas operates a mixed farm with

his parents and wife Diane near Waseka, Saskatchewan. Between them they crop 1500 acres of grains and winter 110 cows. He now includes alfalfa as an integral part of his crop rotation. "For the last number of years I've rotated alfalfa through all my land," Nerbas said. "It's in for four years, the year of establishment and an additional three years in production. Afterwards it's terminated using glyphosate and brought back into an annual crop rotation. It builds up nitrogen and it reduces weeds, particularly wild oats."

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 soil conservation benefits 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 since the formation of N_2O is a natural part of the nitrogen cycle 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. Ideally fertilizer should be banded at seeding or if possible applied throughout the growing season to match application to crop uptake.

Nerbas believes in using soil tests for determining optimal soil fertility to increase production and increase biomass. "If it calls for putting on X amount of nitrogen to grow X amount of biomass I put it on," Nerbas said. " It lets me grow more grain and I'm probably doing a good job from a greenhouse stand point. Some guys spend lots of dollars on herbicides to make sure they have a clean crop. I believe in spending a few extra dollars on fertility and make sure that the crop is competitive."

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."

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