Crop Management Practices

to Mitigate Greenhouse Gases

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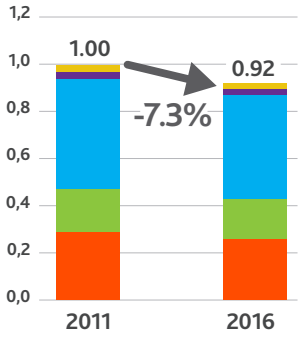
Crop production* is a source of agricultural greenhouse gas (GHG) emissions, mostly in the form of nitrous oxide gas (N_2O) emitted from soils.

Nitrogen inputs used in crop production are the major contributors of agricultural nitrous oxide emissions. As part of the natural nitrogen cycle, production of nitrous oxide in soils mainly occurs due to two microbial processes (nitrification and denitrification) and are regulated by several soil factors.

Crop production* includes all crops grown on the farm while the term **feed production used in the LCA results also includes a small portion of crops purchased off farm and used for feed.*

LOWERING THE CARBON FOOTPRINT OF CANADIAN MILK PRODUCTION

(kg CO_2 equivalent/kg of milk)



Dairy Farmers of Canada conducted two life cycle assessments to measure the impact of the adoption of best practices on lowering the carbon footprint of milk production and identify areas for continuous improvement. The adoption of best practices helped lower the carbon footprint of milk production by 7.3% in five years.

- Livestock management (48%)
- **Feed production (28%)**
- Manure management (18%)
- Transport
- On-farm energy and infrastructure → (6%)

Source: Life cycle assessment (LCA) of milk production update (2018)

INFORMED BY SCIENCE, FARMERS CAN CONTINUE TO ADOPT BEST PRACTICES FOR LIVESTOCK, MANURE AND FEED MANAGEMENT THAT BENEFIT THE ENVIRONMENT.

1 Spring Manure Application

Spring manure application is a promising management practice to mitigate GHG emissions.

Compared to fall manure application, spring manure application reduces up to 10% of total nitrous oxide emissions from cropping systems.

Reduction by up to 10%

Fall application of nitrogen increases the likelihood of nitrogen losses through leaching and enhanced nitrous oxide production.

Spreading nitrogen in the spring reduces nitrogen losses through leaching and nitrous oxide production.

Example of a manure injection system:

Nitrogen leaching can result in indirect nitrous oxide emissions due to processes that take place in groundwater or surface water, which are linked to field practices.

2 Reduced Tillage

Studies conducted in the Prairies reported lower nitrous oxide emissions from no-till plots compared to conventional tillage. No-till also reduces total GHG emissions from western Canadian croplands by increasing the storage of soil carbon.

Example of a reduced tillage field:

Reduced tillage also improves soil quality, promotes biodiversity in and around the soil, and reduces soil erosion and compaction.

3 Soil Testing

Optimizing nitrogen application based on soil testing and yield target can reduce nitrous oxide emissions by about 10%.

Yield target helps determine crop nitrogen requirements and soil testing provides a better understanding of the nitrogen available for plant growth.

Estimating the nitrogen fertilizer requirement using yield target and soil test results helps add the right amount of nitrogen for plant growth and yield expectations.

This project was funded in part by Agriculture and Agri-Food Canada under the Agricultural Greenhouse Gases Program (2010-2015).

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

4 Perennials in Rotation

Increasing the proportion of perennials in rotation resulted in TWO times more carbon sequestration compared to annual cropping with the same nitrogen input.

Though annual crops have higher carbon sequestration rates during the growing seasons, the total sequestered carbon over a year is higher with perennials due to their longer growing season. Compared to annuals, the extensive root mass of perennial crops, particularly in deep soils, helps store more soil organic matter in deeper depths.

Additional Information

Greenhouse gas emissions from soil and cropping systems will vary from year-to-year, but there are clear benefits associated with soil testing to match crop nutrient needs to inputs; implementing reduced tillage systems; and increasing perennial use in crop rotations and spring manure application.

Sources

FARM-SCALE ASSESSMENT OF GREENHOUSE GAS MITIGATION STRATEGIES IN DAIRY LIVESTOCK-CROPPING-SYSTEMS PROJECT

claudiawagnerriddle.uoguelph.ca/completed-projects/dairy-ghg

MANURE APPLICATION

Best Management Practices: Manure Management, Ontario Ministry of Agriculture, Food and Rural Affairs:
www.omafra.gov.on.ca/english/environment/bmp/manure.htm

Best Management Practices: Greenhouse Gas Reduction in Livestock Production Systems, Ontario Ministry of Agriculture, Food and Rural Affairs:
www.omafra.gov.on.ca/english/environment/bmp/ghg.htm

Manure Application, Government of Alberta:
www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/faq7579

REDUCED TILLAGE

Reduced tillage helps reduce carbon dioxide levels, Soil Conservation Council of Canada:
www.soilcc.ca/ggmp_feature_articles/2004/2004-02.php

NITROGEN AND SOIL TESTING

Soil Fertility & Crop Nutrition, Ontario Ministry of Agriculture, Food and Rural Affairs:
www.omafra.gov.on.ca/english/crops/soils/fertility.html

Nutrient Management Planning, Government of Alberta:
www.alberta.ca/nutrient-management-planning.aspx

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