

Climate Smart Agriculture in Alberta



Cropping Systems

Actions that reduce greenhouse gas (GHG) emissions are increasingly important to consumers. These bring other “climate smart” benefits of increased productivity and improved adaptation to changing climates to your farm.

By increasing efficiencies of nutrient and fuel use, farmers are already taking important steps to lower the carbon footprint of crop production and improve resilience to changing climates. Continued leadership and demonstrations of progress in these areas are also resulting in new environmental market opportunities.

GHG SOURCES AND SINKS

Close to half of Alberta’s agricultural GHG emissions are from the cropping sector¹. About 30% of agricultural emissions are nitrous oxides from fertilizer, manure, tilled soil, crop residues and compost¹. Nitrous oxide has close to 300 times more global warming potential than carbon dioxide and is affected by soil conditions, moisture, temperature and application method.

About 20% of Alberta’s agricultural emissions are carbon dioxide from fossil fuel use, tillage, fertilizer application and the decomposition of soil organic matter¹. These emissions are mainly affected by tillage intensity and amount of equipment passes.

REMOVING EMISSIONS

Carbon dioxide emissions from agricultural soils are declining due to conservation tillage and lower summer fallow acres. The benefits include fuel savings and reduced wear-and-tear on equipment. Less soil disturbance and higher yields increase soil carbon inputs, bringing important benefits of improved water infiltration and nutrient cycling which increases the capacity of soils to adapt to changing climates.



Conservation tillage – No-till, direct seeding or reduced tillage improve soil carbon storage while lowering fuel use, nitrous oxide emissions, as well as losses of soil and nutrients from erosion by water or wind.

Perennial crops – Including perennials in an annual



rotation improves nutrient uptake and soil carbon storage, due to deeper rooting and less soil disturbance. Crop rotations also help you reduce threats of disease, insects, pests and weeds, and can lower production risk by diversifying operations.

Cover crops – Seeded into or following an annual crop, cover crops use excess nutrients and take advantage of spring moisture if not winter killed. Benefits include increased soil carbon inputs and protection from wind and water erosion after annual crop harvest. Care is needed in drier areas where there may be competition with the following crop for moisture.

Other practices - Lowering emissions by increasing soil carbon storage can also result from converting marginal cropland and riparian areas to perennial crops or woody biomass.

REDUCING EMISSIONS

Management to improve nutrient use efficiency, lower nitrous oxide emissions and save you costs is about matching nutrients with crop needs. A focus on optimizing inputs will help you develop effective responses to a range of climate conditions.

- Soil sampling² is key to knowing what levels of nutrients are in a soil and if there are limitations to crop growth.
- The Alberta Farm Fertilizer Information and Recommendation Manager (AFFIRM)³ links soil test results, crop type, nutrient content of fertilizer and yield goal.

- Alberta's Manure Management Planner⁴ shows you how to balance manure sample test results with crop needs.
- Time nutrient application as close as possible to maximum crop uptake.
- To increase nutrient availability and avoid losses, band commercial fertilizers to the side of the seed row rather than broadcast. Incorporate (solid) or inject (liquid) manure.

REPLACING EMISSIONS

Biofuels made from Alberta-grown canola are helping to lower fossil fuel emissions. Planting shelterbelts and woodlots on marginal cropland and riparian areas stores carbon has potential for use as a renewable biomass energy feedstock. Roots of woody biomass crops also help stabilize soils in erosion prone areas.

INCENTIVES FOR IMPROVEMENT

In addition to gains in efficiency and adaptation from reducing emissions, a number of programs are available to help you with improvements. There's also opportunities to learn more about environmental markets by selling carbon offsets.

For more information, see:
www.agriculture.alberta.ca/climatesmart

Sources

- ¹Environment Canada. 2018. National Inventory Report 1990-2016: Greenhouse Gas Sources and Sinks in Canada, <http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=83A34A7A-1>
- ²Soil Sampling and Testing, [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex1341](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex1341)
- ³Alberta Farm Fertilizer Information and Recommendation Manager (AFFIRM), [https://www1.agric.gov.ab.ca/\\$department/softdown.nsf/main?openform&type=AFFIRM&page=information](https://www1.agric.gov.ab.ca/$department/softdown.nsf/main?openform&type=AFFIRM&page=information).
- ⁴Manure Management Planner (MMP), [https://www1.agric.gov.ab.ca/\\$department/softdown.nsf/main?openform&type=MMP&page=information](https://www1.agric.gov.ab.ca/$department/softdown.nsf/main?openform&type=MMP&page=information)



Ways that you can lower GHGs, while increasing efficiency and improving climate adaptation.

Practice Improvement	Reduce Nitrous Oxide	Reduce Carbon Dioxide	Increase Carbon Storage	Challenges	Co-benefits
Reduce Emissions - Nutrient Management					
Increase efficiency of nitrogen fertilizer use with right timing, rates, placement and product	- -			Soil sampling costs, logistics in spring seeding, timing, labour	Higher yields, potential offsets*
Apply manure to unmanured soils	-		+	Transportation costs	Improved soil water holding capacity and nutrient cycling, fertilizer savings
Remove Emissions - Carbon Sequestration					
Conservation cropping	-	-	+	Specialized equipment, crop residue management	Fuel and labour savings, improved soil quality, offsets*
Reduce or eliminate summerfallow	-	-	++	Wet spring conditions	Fuel savings, offsets*
Increase perennials in annual rotations	-	-	++	Lower returns	Some fuel and fertilizer savings
Convert marginal annual cropland to perennials	-	-	++	Lower returns	Fuel savings
Cover crops			+	Some costs, possible moisture competition in drier regions	Provides protection from erosion by wind and water
Plant windbreaks, woodlots, agroforestry			+++	Monitor to manage weeds, potential obstacles to field operations	Saves costs of inputs on marginal lands
Replace Emissions – Renewable Bioenergy					
Biofuels		-		Equipment retrofit	Offsets*
Biomass		-		Inconsistent supply, capital cost recovery	Offsets*

Symbols: - Emission reductions, + Emission removals. Impact shown by number of symbols varies with site conditions.

*Carbon offsets may be available with verifiable records to document practice improvement.