Fertilizer: Reducing Emissions, Increasing Competitiveness

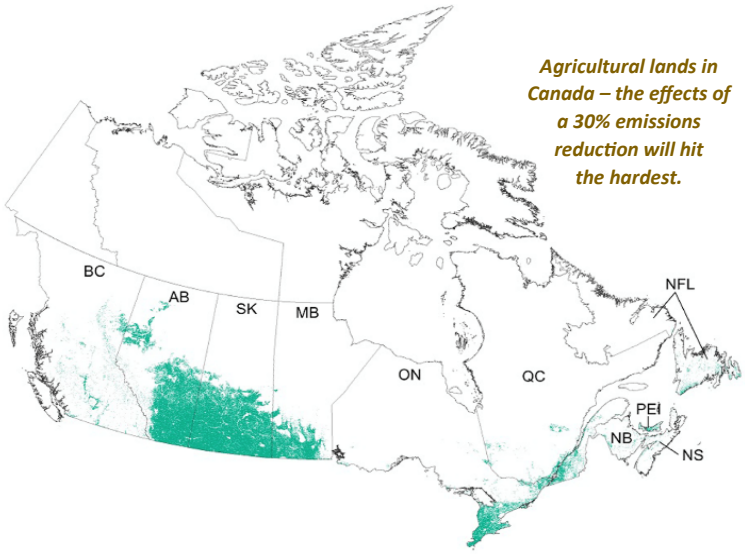
The Government's New Climate Plan

Agriculture is the cornerstone of Canada's food and nutrition security. Reductions in emissions cannot come at the cost of reduced output of food. Reconciling the dual objectives of increased food production and reduced emissions requires increasing the efficiency of agricultural practices so farmers can get more out of all the inputs and resources they use – thereby minimizing greenhouse gas emissions while maximizing soil carbon sequestration potential of agriculture soils.

In December 2020, the Government of Canada released *A Healthy Environment and a Healthy Economy* – a plan which pledges to reduce emissions from fertilizer by 30% below 2020 levels.

In initial conversations with Agriculture and Agri-Food Canada (AAFC), the government has stated their intention to pursue an absolute emissions reduction of 30%, rather than an emissions intensity reduction of 30%. This short-sighted approach to reducing emissions will result in the need to reduce nitrogen fertilizer use and will have considerable impact on Canadian farmers' incomes and reduce overall Canadian exports and GDP.

Canada's fertilizer industry has a significant role to play in achieving both the government's target to net-zero emissions by 2050 and reaching $75 billion in agri-food and seafood exports by 2025.



Agricultural lands in Canada – the effects of a 30% emissions reduction will hit the hardest.

Fig. 1. The extent of agricultural land in Canada in 2016. Source: derived from AAFC Annual Crop Inventory data (AAFC, 2016a). BC: British Columbia; AB: Alberta; SK: Saskatchewan; MB: Manitoba; ON: Ontario; QC: Quebec; NB: New Brunswick; NS: Nova Scotia; PEI: Prince Edward Island; NFL: Newfoundland and Labrador. Agricultural land includes the following crop inventory categories: grassland, agriculture (undifferentiated), pasture/forages, too wet to be seeded, fallow, cereals and all crops categories (categories 110-199 inclusive).

- Agricultural productivity of major field crops in Canada has increased by about 34% since 2005 through agricultural intensification and adoption of new, innovative technologies.
- Production of canola, Canada's most valuable and nutrient intense crop, has increased by about 80% in that same timeframe.
- Fertilizer consumption in Canada has remained on the rise over the past two decades in support of these increased crop yields and global demand for food is still increasing at a record rate.

What's the Difference Between Absolute Versus Intensity?

Any federal emissions reduction target must be based on emissions intensity and consider emissions per unit of crop produced to maintain growing agricultural exports.

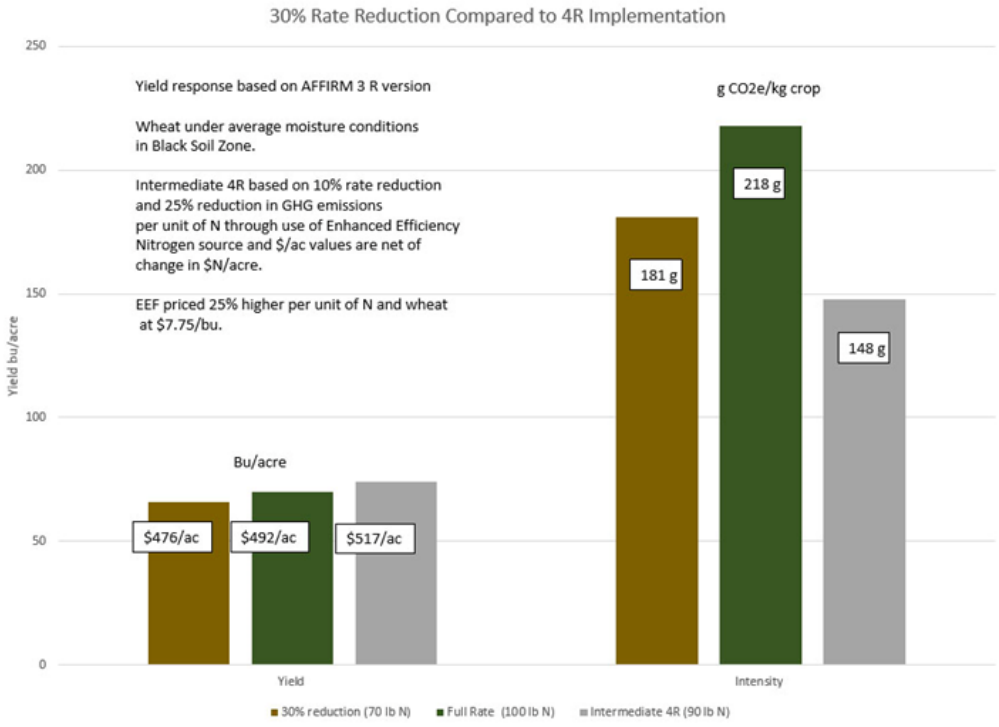
Focusing on absolute emissions from the sector will have severe consequences to the competitiveness of farmers and the fertilizer industry.

Total Emission Reduction puts a cap on the total emissions allowable from fertilizer at 30% below 2020 levels. As the yield of Canadian crops is directly linked to proper fertilizer application this creates a ceiling on Canadian agricultural productivity well below 2020 levels.

Emissions Intensity Reduction focuses on reducing the emissions it takes to produce a bushel of crop. This definition of emissions reduction does not put any restrictions on Canadian farmers, rather it allows crop yields to continue to grow while progressively minimizing the emissions from each crop.

What are the Consequences of Absolute Reductions?

Policies that discourage fertilizer use can actually increase GHG emissions. A reduction in grain production in Canada through less fertilizer use, would not only have a significant negative impact on soil organic carbon, but would lead to carbon leakage to other jurisdictions. Investments aimed at sustainable agricultural intensification to improve crop yields per unit of existing land area should be at the forefront globally. The concept of sustainable intensification has been endorsed by the United Nations through FAO's Climate-Smart Agriculture strategy as well as sustainable supply chains that are looking for low intensity supply – an absolute emissions reduction is out of step with this global direction.



Data compiled using Alberta Farm Fertilizer Information and Recommendation Manager (AFFIRM) - an application that helps land managers evaluate fertilizer management options and formulate programs that fit their farm budget. It creates estimates of yield and cost based on soil zones. Results shown would generally apply to the Black and Dark Brown soils zones in Alberta and Saskatchewan.

It is estimated that a 30% absolute emission reduction for an a farmer with 1000 acres of canola and 1000 acres of wheat, stands to have their profit reduced by approximately $38,000 - $40,500/ annually.

In 2020, Western Canadian farmers planted approximately 20.8 million acres of canola. Using these values, cumulatively farm revenues from canola could be reduced by $396M - $441M on an annual basis. Wheat famers could experience a reduction of $400M.

The chart above demonstrates three scenarios and the impact on both crop productivity and the associated emissions. Implementation of intermediate 4R practices increases crop productivity and farmer profit, while also significantly reducing emissions, compared to a 30% N rate reduction that only has marginal impacts on intensity of emissions, and negatively impacts farmer profits. While implementing a total emissions reduction strategy based solely on reduced use of nitrogen fertilizer will reduce emissions, our initial analysis suggests that adoption of an intermediate suite of 4R practices reduces the emissions intensity by almost double. While the price of the crop remains the same, as these are set by market forces, cropping system productivity for each model changes significantly.

The difference in profit between a per acre emissions reduction based on a 30% reduction in nitrogen rate and implementation of intermediate 4R practices is approximately $41 per acre.

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What is 4R Nutrient Stewardship?

For more than a decade, Fertilizer Canada has worked with Canadian farmers and the fertilizer industry to develop and promote 4R Nutrient Stewardship - a science-based approach to fertilizer management that involves applying the Right Source of fertilizer at the Right Rate, Right Time and Right Place. Use of 4R Nutrient Stewardship optimizes plant nutrient uptake, increases yield and maximizes profitability, while also minimizing nitrous oxide emissions.

4R Nutrient Stewardship is an innovative solution to support the government's agricultural goals of reducing greenhouse gas emissions and increasing the efficiency of agricultural practices for enhanced food production. Through 4R Nutrient Stewardship, our industry can positively contribute to, and achieve tangible and verifiable results.

BMPs that Reduce GHGs

Source	Rate
• Avoid nitrate sources in fall • Use Enhanced Efficiency Nitrogen • Include legumes in rotation • Balance nutrition	• Soil test for residual N • Account for mineralization • Set realistic target yields • Adopt variable rate
Time	**Place**
• Fall apply after soil cooled • Split apply	• Band N • Adopt controlled traffic

What is the 4R Climate Smart Protocol?

The 4R Climate-Smart Protocol was developed with input and review from Canada's top scientists in GHG emissions, as well as leading agronomists from government and industry. The Protocol allows for farm-specific measuring and reporting of emission reductions. Improved nitrogen management within the Protocol is delivered through the implementation of a 4R Nutrient Stewardship Plan at the farm level. Farmers wanting to participate in a project develop a 4R Nutrient Stewardship consistent plan with an accredited professional advisor (APA) such as a Certified Crop Advisor. The APA helps the farmer develop a set of sustainability goals that incorporate GHG reduction measures and BMPs that must meet certain thresholds into a plan.

The Protocol's accounting of GHG emissions is comprehensive, using a series of emission factors which were developed by AAFC.

The protocol, combined with an increase in the carbon price, can create a significant market opportunity for farmers, an important advantage for Canada's trade exposed cropping industry, and an important step forward in Canada's GHG policy framework.

The 4R Climate-Smart Protocol results in a reduction in greenhouse gas emissions by as much as 35%.

If this were implemented across Western Canada, it would reduce emissions by 2-3 MT CO_2e annually.

A benefit analysis of 4Rs for Saskatchewan based on this protocol provided $237 million in credits at $150/t.

Provincial: Fertilizer Canada has existing 4R agreements with major crop producing provinces - Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Prince Edward Island. Saskatchewan, Manitoba and Ontario have included 4R Nutrient Stewardship in their official climate plans. A Made-in-Saskatchewan Climate Change Strategy has set a target of 25% of Saskatchewan's cropland under 4R Designation by 2025.

National: The Canadian Canola Growers Association has set a target of 90% of canola under 4R Nutrient Stewardship by 2025.

4 million acres are certified under the 4R Designation program for agri-retailers. This is out of a total of 80+ million acres of Canadian cropland – so the program has more to accomplish, but is also stringent on what is being captured as 4R compliant.

International: The Food and Agriculture Organization of the United Nations, the United Nations Global Compact, the World Business Council and the International Joint Commission have endorsed the 4R framework as a measure for sustainable nutrient management.

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What is the Solution?

Carbon is a farm commodity, and we must act quickly to embed this in policy. Including this year, there are only nine growing seasons remaining to 2030. Solutions such as 4R Nutrient Stewardship and the 4R Climate-Smart Protocol must be at the core of any plan to reduce agricultural emissions to ensure that farmers are rewarded, not punished.

Our research shows that implementation of basic practices under the 4R Climate-Smart Protocol can reduce nitrous oxide emissions by 15% - our survey tells us that 45% of canola farmers surveyed are *potentially* implementing a basic or *near* basic level of 4R practices on their farms. When estimating nitrous oxide emission reductions on the Canadian Prairies with 4R adoption, our study shows that a 30% reduction in emissions below 2020 levels is possible with between 80 - 90% adoption of *intermediate* 4R practices.

While 57% of farmers surveyed believe their fertilizer practices follow the 4Rs to at least a basic level, only 26% of growers surveyed report they have worked with a 4R Designated or certified agronomist and only 6% have a 4R Plan in place. There is clearly an opportunity to increase the adoption and sophistication of 4R implementation on Canadian Farms.

Canada has the opportunity to become a world leader in reducing greenhouse gas emissions on farms by helping growers become climate-smart. We believe that proactive efforts made by Canada's fertilizer industry will not only support Canada's targets, but will help position the Government of Canada with a leading example on the international stage in climate change adaptation, resilience and mitigation.

To reduce agricultural emissions, the Government of Canada must:

1 Focus on Emissions Intensity

A focus on absolute emissions is short-sighted and threatens the agricultural community, and the provincial economies that rely on them. We cannot meet our export or growth targets with this mindset. Focusing on emissions intensity will deliver outcomes that are better for the environment and for farmers.

2 Recognize 4R Nutrient Stewardship

The Federal Government must recognize 4R Nutrient Stewardship as the solution to managing agricultural emissions. The government should immediately create a National Committee for 4R Nutrient Stewardship, working with farmers and the fertilizer industry to increase uptake of the program. We cannot wait until the federal strategy is complete.

3 Implement the 4R Climate-Smart Protocol

Farm organizations across Canada have asked the Government of Canada to implement the 4R Climate-Smart Protocol. Thus far, it has not been prioritized. With very few growing seasons between now and 2030, the protocol must be implemented as soon as possible to ensure targets are met.

4 Fix the National Inventory Report

In Canada's national inventory, N_2O emissions are not measured directly but rather are estimated based on nitrogen inputs. 4R Nutrient Stewardship best management practices are not being captured in the National Inventory Report (NIR) and therefore does not present an accurate estimate of the nitrous oxide emissions from agriculture in Canada. Integration of 4R Nutrient Stewardship into the NIR is necessary to ensure that progress towards a target can be monitored appropriately.