

Using Innovative Digital Tools to Address Current Issues in Animal Agriculture

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New Paradigm in Agriculture



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Farmer 4.0: How the Coming Skills Revolution Can Transform Agriculture



A fourth agricultural revolution is underway, and this one isn't powered by seeds or diesel. It's all about data.

As Canadian farmers leave traditional tasks to smart machines, and focus on strategy and systems, they'll be better positioned than ever to feed a fast-growing global population. But to do that, they'll need a wide range of new skills, as well as enhanced old skills, that Canada isn't developing anywhere near fast enough.

By John Stackhouse
August 27, 2019

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Challenges in Agriculture

Sustainable intensification

- Process or system where agricultural yields are increased without adverse environmental impact and without the conversion of additional non-agricultural land

Pretty and Bharucha. 2014. Sustainable intensification in agricultural systems. *Annals of Botany* 114(8):1571-1596.



Challenges in Practice

Fertilizer emissions reduction target: Completed consultation

From: Agriculture and Agri-Food Canada

Follow:     

Current status: Closed

This consultation ran from March 4, 2022 to August 31, 2022.

Agriculture and Agri-Food Canada launched additional consultations to help guide the development of an approach for achieving Canada's fertilizer emissions reduction target of 30% from 2020 levels by 2030.

The Government of Canada consulted with Canadians, including farmers, producers, processors, Indigenous communities, women in agriculture, youth, environmental organizations, small and emerging sectors as well as other key stakeholders and partners.

If you have additional comments or questions please contact us at aafc.fertilizer-engrais.aac@agr.gc.ca.

<https://agriculture.canada.ca/en/about-our-department/transparency-and-corporate-reporting/public-opinion-research-and-consultations/share-ideas-fertilizer-emissions-reduction-target>



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Challenges in Practice

Canada Can Reduce GHG Emissions from Fertilizer Use Without Jeopardizing Food Security, New Report Says



NEWS PROVIDED BY
[Fertilizer Canada](#) →
Sep 07, 2022, 07:00 ET

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OTTAWA, ON, Sept. 7, 2022 /CNW/ - Canada's agricultural exports are crucial to global food security. A new report released today from Fertilizer Canada and the Canola Council of Canada (CCC) shows Canada can continue to increase crop yields while significantly reducing greenhouse gas (GHG) emissions from fertilizer application using available tools and technology. Supporting farmers to increase crop yields is vital to meeting Canada's agriculture export targets and global demand.

The report shows a 14 per cent reduction in GHG emissions by 2030 can be achieved without jeopardizing food security through the adoption of aggressive, but attainable levels of 4R best management practices (BMPs). 4R BMPs (Right Source @ Right Rate, Right Time, Right Place®) help producers optimize fertilizer to reduce environmental impacts while maximizing economic outcomes.

<https://www.newswire.ca/news-releases/canada-can-reduce-ghg-emissions-from-fertilizer-use-without-jeopardizing-food-security-new-report-says-829910123.html>



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Challenges in Practice

Up to 3,000 'peak polluters' given last chance to close by Dutch government

State attempts to push through plans to shut hundreds of farms to cut nitrogen oxide emissions



📷 The Dutch prime minister, Mark Rutte, after meeting farmers to discuss nitrogen plans in July.
Photograph: Koen van Weel/EPA

**The
Guardian**

“The nitrogen minister, Christianne van der Wal, said farmers would be offered more than 100% of the value of their farms to quit”

<https://www.theguardian.com/environment/2022/nov/30/peak-polluters-last-chance-close-dutch-government>



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The Role of Technology in Agriculture

Precision Agriculture

- A way to automate site-specific management using information technology
- Closely related to sustainability

Bongiovanni and Lowenberg-Deboer. 2004. Precision agriculture and sustainability. Precision Agriculture 5(4):359-387.



The Role of Technology in Agriculture

Precision Livestock Farming (PLF)

- Combined application of single technologies or multiple tools in integrated systems for real-time and individual monitoring of livestock

Aquilani et al. 2022. Review: Precision Livestock Farming technologies in pasture-based livestock systems. *Animal* 16(1):100429.



Digital Tools for PLF in Manitoba

- Animal tracking in dairy farms using indoor positioning systems (IPS)
- High-resolution mapping of grasslands for cattle grazing using hyperspectral cameras



Indoor Positioning System for Dairy Farms

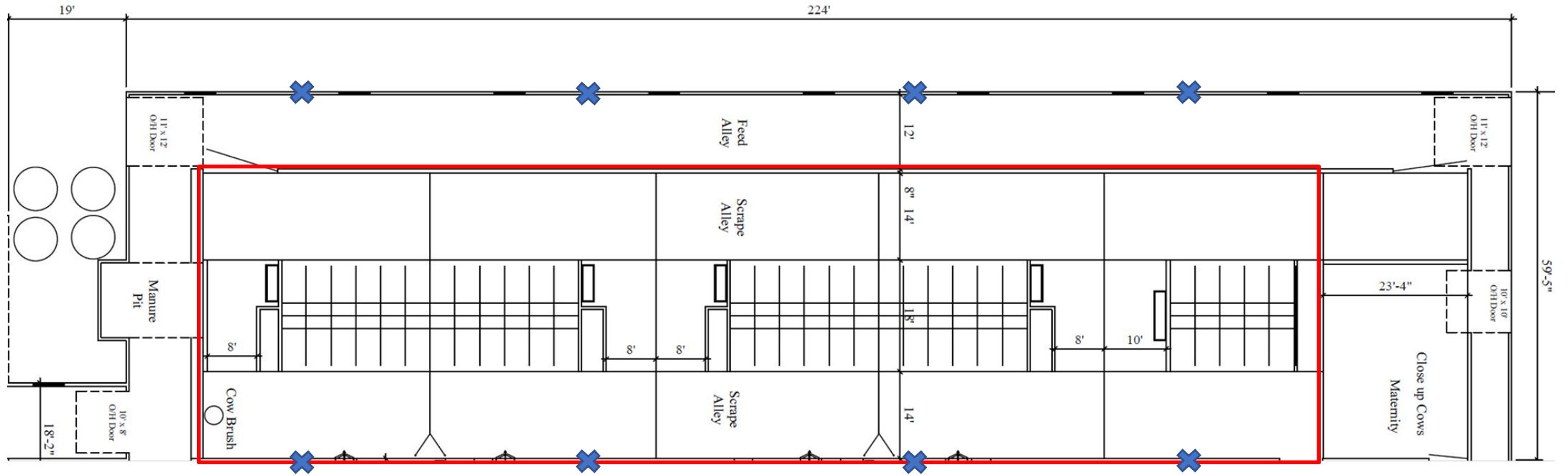
Glenlea Research Station

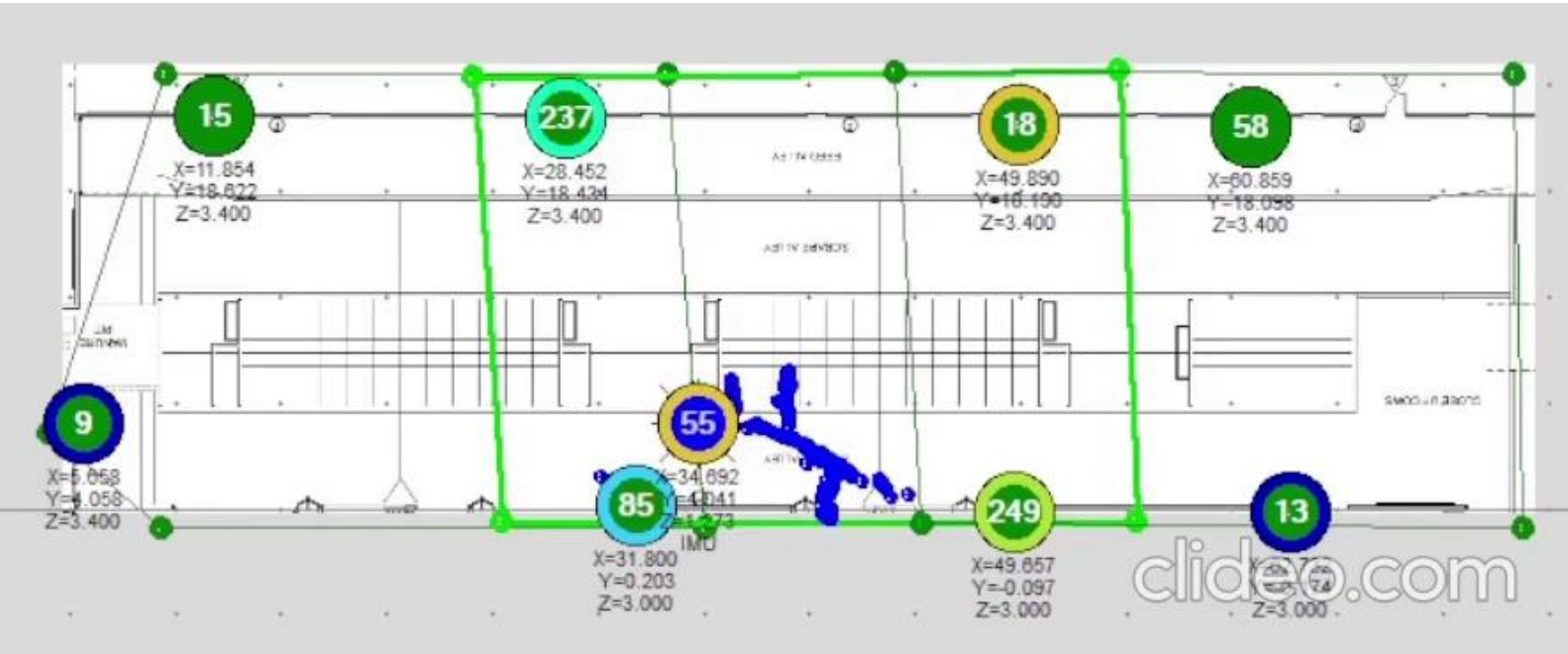
- 60 dairy cows



Indoor Positioning System for Dairy Farms

Glenlea Research Station





Indoor Positioning System for Dairy Farms

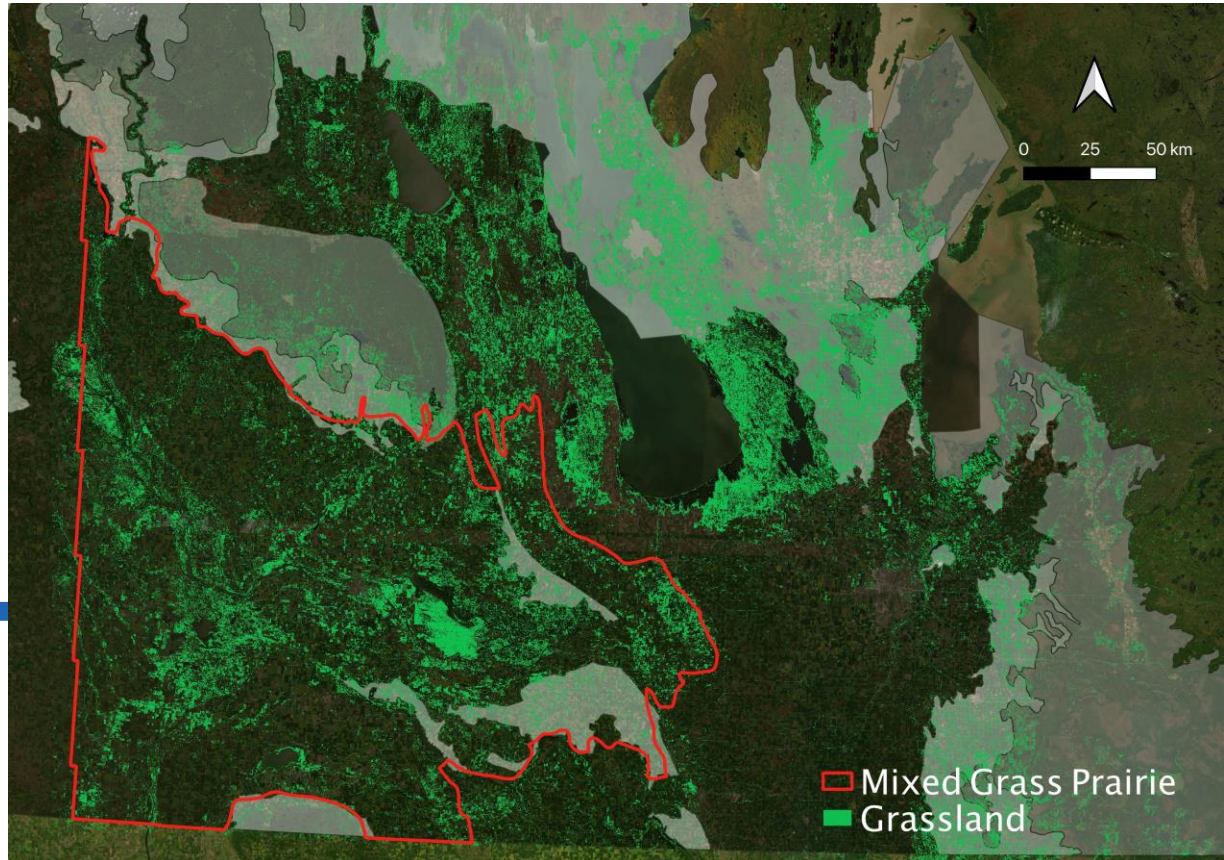
Information collected from individual cows

- 24/7 location
 - Close to feed source?
 - Close to milking robot?
- Behaviour
 - Perching?
 - Actually feeding?
- Daily travel distances
- Average travel speed



Hyperspectral Cameras for Grassland Mapping

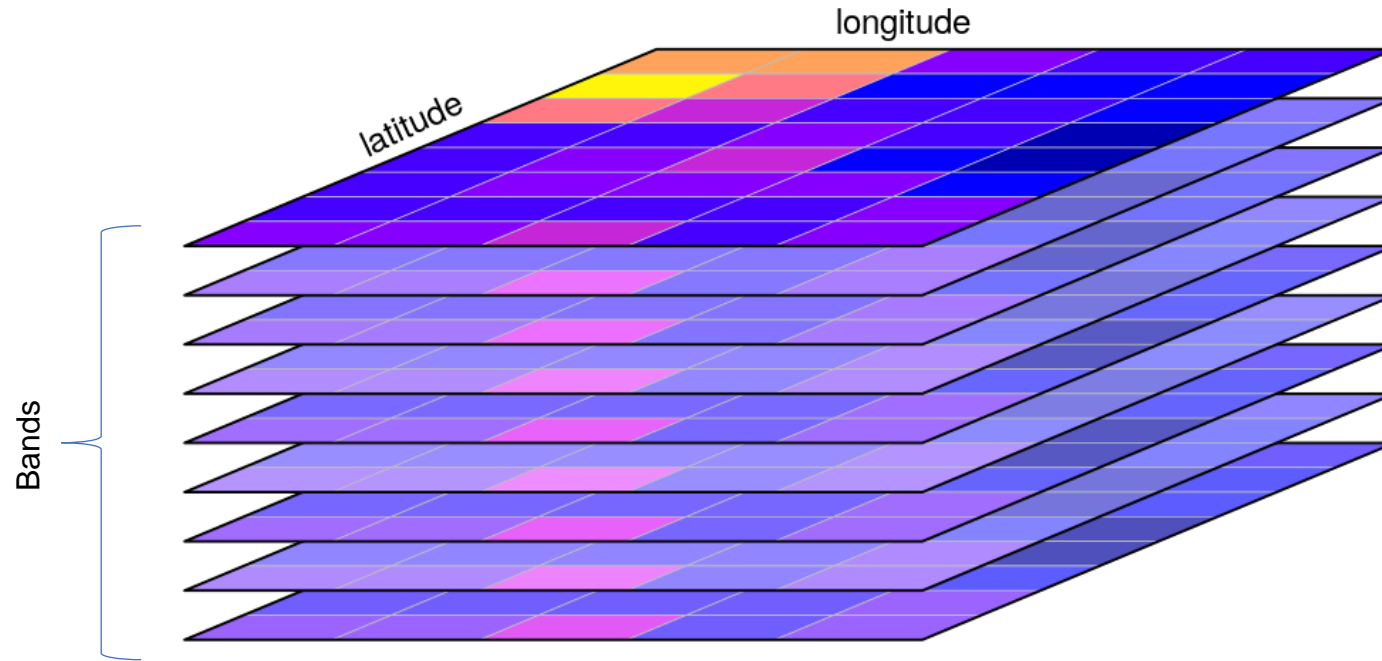
Mixed Prairie region in southwestern Manitoba



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Hyperspectral Cameras for Grassland Mapping

High spatial, temporal and spectral resolutions



- Centimeter-level accuracy
- Monthly scheduled visits
- 490 bands

Image adapted from <https://r-spatial.github.io/stars/>

Hyperspectral Cameras for Grassland Mapping

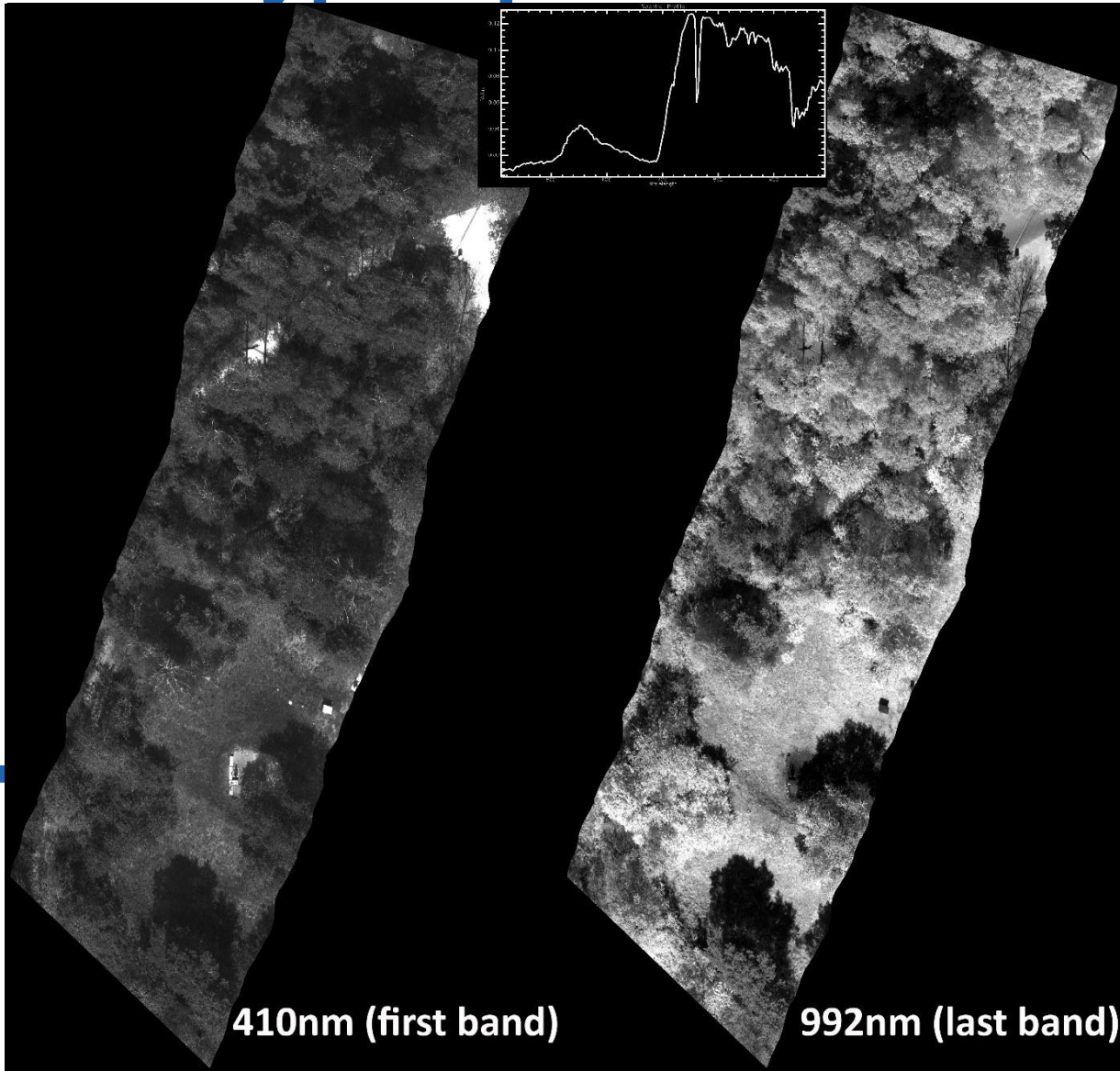


Image adapted from:
<https://www.hypex.com/hyperspectral-imaging/key-quality-parameters/scientific-grade-quality/>



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Hyperspectral Cameras for Grassland Mapping

Information collected from quarter-sections

- Mapping of grassland at high spatial resolution
 - Stand composition
- Biomass productivity
- Assessment of carbon stocks



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Questions?



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Challenges in Practice

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 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.

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.

<https://fertilizercanada.ca/wp-content/uploads/2021/05/Emissions-Reduction-Initiative-Impacts-Solutions.pdf>

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.

