



Canadian Crop Production Emissions

According to Canada's official greenhouse inventory, roughly half of Canadian agriculture GHG emissions are from crop production:

- 27% of total agriculture sector emissions are related to fertilizer use,
- 9% are from crop residue decomposition and other direct soil management sources,
- A further 20% of emissions are from on-farm fuel use, much of which supports crop production (fuelling tractors and heating greenhouses, for example)¹

The largest greenhouse gas emission contributor from Canadian crop production is nitrous oxide (N₂O) emissions from nitrogen fertilizer application. National nitrogen fertilizer use, which stood at about 0.94 million tonnes of nitrogen in 1981, more than doubled by 2011 to 2.0 million tonnes, and has continued to rise, reaching 2.6 million tonnes in 2016. Use in Western Canada increased by more than 150% (from 1981 to 2011), while use in Eastern Canada increased by only 22% during the same time period.² The increased use of fertilizers in the Prairie provinces (where 85% of Canadian cropland acreage is located) is the major driving factor of national agriculture sector GHG emission increases.¹

Many of the approaches to reducing nitrous oxide emissions can be broadly applied to annual crop production systems:

- Using manure efficiently to reduce N₂O emissions from manure application and reduction of synthetic fertilizer use
- Precision use of fertilizer (right time, right place, right amount), to reduce overall fertilizer use, decrease emissions and decrease nitrogen run off
- Greater use of legumes as a nitrogen source (through cover cropping or in rotations)
- Use of cover crops (sown between successive crops) to remove excess available nitrogen
- Avoiding the use of summer fallow (leaving the land unplanted, with no crop nitrogen uptake, for a season)
- Adjusting tillage intensity (under some conditions no-till practices can reduce emissions)³

Reducing N₂O emissions by improving the efficiency of nitrogen and fertilizer use has many other benefits: reducing the cost of production by lowering fertilizer inputs, avoiding GHG emissions from fertilizer production, and reducing the amount of nitrates, ammonia and other nitrogen pollutants entering the environment.

Net Zero Wheat Production

Research led by Agriculture and Agri Food Canada and published in Nature, provides results from a 25 year trial in Saskatchewan that integrated four of the practices above – fertilizing crops based on soil tests, reducing summerfallow frequencies and rotating cereals with grain legumes. The combination of approaches lowered the carbon footprint of the wheat produced, and increased carbon sequestration in the soil to the point where the wheat took up more CO₂ from the atmosphere than the greenhouse gases emitted during its production. These findings are supported by similar research on wheat production in the UK, Poland, Denmark and Australia.⁴



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References:

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- ² Clearwater, R. L., T. Martin, and T. Hoppe, editors. (2016) *Environmental sustainability of Canadian agriculture: Agri-environmental indicator report series – Report #4*. Agriculture and Agri-Food Canada, Ottawa, ON. http://publications.gc.ca/collections/collection_2016/aac-aaafc/A22-201-2016-eng.pdf
- ³ Agriculture and Agri-Food Canada (2014) *Nitrous Oxide*
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- ⁴ Gan et. al, 2014 Improving farming practices reduces the carbon footprint of spring wheat production. *Nature*, 5:5012. DOI: 10.1038/ncomms6012