REDUCING THE EMISSIONS INTENSITY OF LIVESTOCK PRODUCTION:

CASE STUDIES OF SUCCESS

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

CANADA

Scale: National
System: Mixed
Sector: Beef

Producing beef with lower greenhouse gas emissions

Canada produced 32% more beef in 2011 than in 1981, mostly due to higher carcass weights. This was done with 29% less breeding stock, 27% fewer slaughter cattle and 24% less land, and with a 14% reduction in greenhouse gas emissions intensity.

Background

Canada produces around 2% of the world's beef and is the fifth largest global exporter of beef, producing 1.41 million tonnes in 2014. Beef production contributes an estimated CA$33 billion annually to the Canadian economy. The national beef herd is significantly larger than the dairy herd - 3.85 million beef cows compared to 0.962 million dairy cows in 2011.

Beef farms can be found in every province of Canada, with around 68,500 in total across the country and almost all of those (98%) family owned and operated. Production systems are diverse in terms of numbers of cattle per farm, feeds and feeding management practices employed. Broadly, however, there are three types of farm:

- Cow-calf operations where farmers breed cows to produce calves
- 'Backgrounding' operations where farmers put additional weight on weaned calves through pasture or other high-forage diets
- Feedlot operations where the cattle are fed grain-based diets before slaughter (these are mostly located in Alberta)

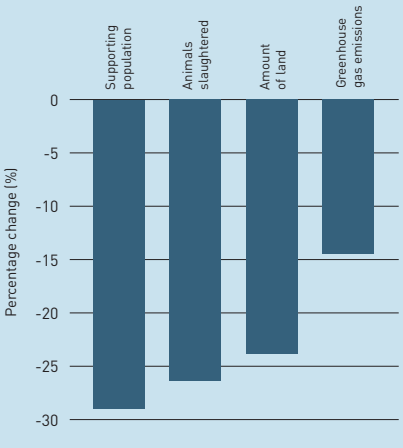
Beef heifers are typically bred as yearlings and calve at two years old. Calving occurs in the winter-spring, with cows having a calving interval of around one year, with an average milk yield of 7 kg/head/day. Calves are typically weaned in the autumn when they are, on average, around seven months old.

Key actions & their effects on productivity, income & food security

Researchers have found that over a 30-year period, Canadian farmers significantly increased the efficiency of beef production. The beef industry in Canada is a small margin business and the volatility in commodity prices means that a sustainable business may experience short-term financial loss, while remaining profitable in the long run. Beef producers must continually improve efficiency of production to adapt to the market conditions. High input costs require not just productivity improvements but changes in marketing practices to ensure the type of product demanded is the product supplied. Failure to respond to changing consumer preferences can result in a shrinking market share.

Productivity gains have been achieved through improvements to average daily gain and slaughter weight, as well as reproductive efficiency. The average carcass weights of steers, heifers, cows and breeding bulls slaughtered in 2011 were 29%, 45%, 19% and 28% heavier, respectively, than those of animals slaughtered in 1981. Twenty-nine percent less breeding stock was required to produce the same amount of beef in 2011 than in 1981 (see Figure 1) and time to slaughter has also been reduced.

Figure 1: Percentage reduction in resource requirements and greenhouse gas emissions (CO_2e) to produce a given amount of Canadian beef in 2011 relative to 1981



The availability of improved genetics and growth promoting technologies such as hormonal implants have been significant contributors to the change in productivity. Farmers have also adopted improved health management techniques, for example vaccines and antibiotics to reduce digestive and respiratory disorders. These have increased conception and survival rates and lowered the effect of morbidity on growth efficiency, as well as improving feed intake and bodyweight gain.

Between 1981 and 2011, the land used to produce a given amount of Canadian beef was reduced by 24%, because less breeding stock and fewer finished cattle were required to produce the same amount of beef. Pasturelands constitute more than 76% of this land base.

There has also been a shift towards the use of high-grain diets for finishing cattle, enabling cattle to be marketed at an earlier age. Extended grazing strategies (e.g. swath, stockpiled and baled grazing) were also more prevalent in the beef herd in 2011.

Effect of actions on emissions intensity of livestock production

Researchers evaluated whether the increases in production efficiency also resulted in an increase in environmental sustainability. While total greenhouse gas emissions were higher in 2011 than in 1981 (28.3 Tg $CO2_2e$ vs 22.1 Tg $CO2_2e$), the emissions intensity per kilogram of liveweight that left the farm was 14 kg CO_2e for 1981 and 12 kg CO_2e for 2011, a decrease of 14%. This arose as a result of declines of 18% in methane, 19% in nitrous oxide, and 16% in carbon dioxide.

These reductions can be attributed to the significant advances in productivity that Canadian beef farmers have achieved in the 30-year period to 2011. If, for example, the reproductive efficiency in 2011 remained unchanged from 1981, then the reduction in emissions intensity would be reduced by 7%. If the yields of feed crops had not been improved, the estimated decline in the intensity of carbon dioxide emissions would not have been realised at all.

Marketing more cattle at an earlier age also contributed to the lower greenhouse gas emissions per unit of liveweight that left the farm in 2011. A larger proportion of calves was sent to feedlots immediately after weaning in 2011 than in 1981. This is important for emissions intensity because older feedlot cattle (e.g. 17-23 months) produce 6-7% more greenhouse gas emissions than younger cattle (e.g. 11-16 months).

Co-benefits and trade-offs

When averaged over the entire production cycle of producing beef in Canada, cattle consume a diet consisting of about 80% forage and 20% grain. As a result of feeding diets high in fiber, enteric methane emissions are also high. Research is on-going to explore the possibility of decreasing methanogenesis in the rumen of forage-fed cattle, while maintaining production efficiency. In addition, further research is needed to examine the impact of beef production on other sustainability metrics, including water use, air quality, biodiversity and provision of ecosystem services.

Implications for adaptation

The assessment of the changes in productivity and greenhouse gas emissions did not address adaptation issues for livestock farming.

Challenges to implementation and adoption

The reductions in greenhouse gas emissions intensity have come about as a result of increasing production efficiency. The Canadian beef industry is focused on continuous improvement and now has a National Beef Sustainability Assessment and Strategy in place. This 'farm to fork' analysis sets industry benchmarks for the future environmental, social and economic sustainability of the industry.

Further information

Journal article from which this case study was derived

Legesse, G., K. A. Beauchemin, K. H. Ominski, E. J. McGeough, R. Kroebel, D. MacDonald, S. M. Little and T. A. McAllister. 2016. Greenhouse gas emissions of Canadian beef production in 1981 as compared with 2011. Anim. Prod. Sci. 56:153-168 doi/10.1071/AN15386

National Beef Sustainability Assessment and Strategy

http://crsb.ca/wp-content/uploads/resources/NBSA_and_Strategy_summary_report_web1.pdf

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