The carbon footprint of dairying in Eastern Canada: A case study

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Greenhouse gas (GHG) emissions from dairying are not only of significant environmental importance, but they may also affect profitability for farmers. In this study a life-cycle assessment (LCA) was carried out to determine the carbon footprint of a typical non-grazing dairy system in Eastern Canada.

This study involved the creation of a virtual farm to determine the carbon footprint of a dairy system in the Napierville region of Quebec. The LCA was conducted over a 6 year period representing the typical lifespan of a Holstein cow in this area. The assessment followed the birth of 65 female Holstein calves, with 60 surviving to first calving at 27 months of age. Following calving cows were retained for an average of 2.75 lactations. Bull and heifer calves in excess of replacement requirements were finished as veal at 6.5 months of age. The LCA used a model called Holos, developed by scientists at Agriculture and Agri-Food Canada, to determine emissions of methane from feed digestion and manure, nitrous oxide from soils and manure and carbon dioxide from on-farm energy use and input production. Differences between the global warming potential of each gas were overcome by expressing emissions as CO_2 equivalents (CO_2e). The carbon footprint of milk production was then estimated as the GHG intensity, defined as the total GHG emissions per kilogram of fat and protein corrected milk yield.

This assessment yielded a GHG intensity of 0.91 kg CO_2e/kg milk produced. Methane was the major GHG accounting for 56% of the total, with 86% of this figure coming from feed digestion. Nitrous oxide emissions accounted for 40% of the total GHG emissions indicating the importance of nitrogen management in dairy systems. Assessment of the individual livestock groups indicated that 64% of the total GHG emissions arose from lactating animals. The contribution of the veal calves was negligible at 3%, with animals less than 12 months of age contributing 10% of total emissions.

Implications: Research is needed to develop ways to reduce methane from feed digestion and improve nitrogen use efficiency as these mitigation strategies could substantially reduce the overall carbon footprint of milk.