

4C-101: Life cycle assessment of waste treatment and additional pork supply chains

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Background

The report presented research on the environmental intensity of pork production, focussing on greenhouse gas (GHG) emissions, energy and water use. It was conducted with the Australian public, the research community and the pork industry in mind. This project aimed to extend pork LCA research in Australia to investigate the GHG emissions for a range of effluent treatment systems and waste management practices, across five pork supply chains in three states. These included a small-medium supply chain comprised of five, closed herd farrow-finish piggeries located in south east Queensland, a Western Australian large conventional piggery, a large outdoor breeder unit and a deep litter grower-finisher unit in WA, a large conventional farrow-finish piggery in Queensland and a conventional breeder, deep litter wean-finish enterprise in southern NSW.

Methodology

The study was an ISO 14040/14044 compliant LCA covering GHG, energy use and water use for the pork supply chain from 'cradle to processor gate'. Supply chains consisted of either 1 large piggery or a series of smaller piggeries selling to a similar market. Inputs and production data were collected from a total of 13 piggeries (~23,000 sow places) over a 12 month period. Inventory data were collected from three meat processing plants. A comprehensive water and energy inventory was collected from each piggery and meat processing plant. GHG emissions were determined using a mass balance modelling approach based on feed intake and animal production to predict manure excretion, and emission factors from the Australian inventory (NGGI) and literature sources. Emissions and impacts from alternative manure management systems were modelled based on a desktop review of alternative emission factors and (as relevant) energy generation potential.

Key Findings/Conclusions

- Total GHG ranged from 5.0 ± 0.7 kg CO_{2-e}/kg to 8.7 ± 1.2 kg CO_{2-e}/kg Retail Pork, with the range in values mainly driven by differences in the manure management system.
- Total embodied energy ranged from 18.8 ± 1.0 MJ/kg to 22.1 ± 1.2 MJ/kg Retail Pork, with differences largely related to diet and production efficiency.
- Consumptive fresh water use ranged from 50.3 ± 4.4 L/kg to 252.8 ± 39.4 L/kg Retail Pork. Several factors contributed to the large range in water use, including housing type, inclusion of irrigated feed products in the diet and losses associated with water supply.
- Stress weighed water use ranged from 16 ± 1.4 L H₂O_e/kg to 62 ± 2.0 L H₂O_e/kg Retail Pork.
- A number of GHG mitigation options are available to the pork industry. Of these, on-site energy generation via anaerobic digestion provided the greatest reductions in GHG and energy demand. Alternative GHG reduction strategies include rapid irrigation of effluent (short hydraulic retention time) or alternative housing (i.e. on litter or outdoor).
- This study provides data and methods that may be used to benchmark industry performance, though this should be done with reference to a larger sample of the industry or a complete industry inventory. Doing so would provide the CRC with a sound benchmark from which to measure practice change in the future. Such measurement of progress is important for the industry in order to 'keep pace' with changed production systems and levels of productivity, both of which drive impacts.

Potential Users of Information

The main users of this information are anticipated to be:

- The pork industry - to provide a benchmark for environmental performance across a number of pork production systems, and to provide insight into strategies to reduce impacts.
- Researchers in the pork industry and potentially in the food supply chain - Researchers may use the data and results here to guide future research.
- Pig farmers - who can use the energy and water use data for benchmarking and can use the GHG information to assist in understanding how to minimise their environmental impacts.
- The general public - at the discretion of Pork CRC, this information may be valuable for members of the general public who are concerned about the environmental impacts of pork