

Title: Carbon Footprint of dairy and suckler beef in Denmark: baseline and potential mitigation alternatives

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Introduction

The aim of this study is to assess the climate change (CC) impacts of Danish beef production, with a relatively granular model that accounts for different production systems (conventional and organic), breed types, and animal groups (e.g. dairy cows, suckler cows, bulls, steers and heifers). Potential strategies (12 scenarios) aiming to reduce CC impacts are also investigated. The baseline year of the assessment is 2021.

Materials and Methods

The average age and the carcass weight (CW) at slaughter of the different animal groups were defined based on the Danish cattle database. Each animal group was associated with average housing, manure, and grazing conditions, and typical feed rations, during grazing and housing periods.

Enteric fermentation emissions were calculated based on the IPCC (2019) Tier 2 approach reported in the Danish National Inventories. Methane and nitrous oxide emissions related to the excreted manure were calculated as a function of the housing type and grazing time, based on standard national values and IPCC (2019) emission factors. The upstream CC impacts related to the production of feed were retrieved from available databases. The environmental impacts were distributed between milk and meat following the IDF 520/2022 guideline.

Results

In 2021, Danish slaughtered cattle contributed to 8.10×10^9 kg CO₂eq, where 2.21×10^9 kg CO₂eq was attributed to the produced beef (CW), while the rest was attributed to the produced milk. The average CC impact of Danish beef in 2021 was 17.9 kg CO₂eq / kg CW.

While dairy beef contributed to 82% of the beef produced in Denmark in 2021, dairy beef contributed to 76% of the beef CC impacts. The difference between the two values is due to the higher CC impact of suckler beef (26.3 kg CO₂eq / kg CW) compared to dairy beef (16.1 kg CO₂eq / kg CW).

Scenario analyses showed that the potential use of 3-NOP additives in dairy cow's feed ration can have a mitigating effect on the CC impact of beef: from 17.9 to 17.4 kg CO₂eq /kg CW (3.1% reduction), and from 2.21×10^9 to 2.14×10^9 kg CO₂eq when focusing on the national impacts attributable to the produced beef (CW).

Combining the 3-NOP scenario with potential changes in the Danish beef production looking towards a reduction of the suckler cow population and an increase in the dairy population,

achieved by avoiding the current export of 1 months old calves (keeping the total meat produced constant), showed a potential reduction in the average CC impacts of beef from 17.9 to 16.5 kg CO₂eq /kg CW (8.1% reduction) – a comparable reduction potential was also evaluated for the national impacts attributable to the produced beef (CW).

Conclusions

The average CC impact of Danish beef in 2021 was 17.9 kg CO₂eq / kg CW. Considerable reductions in the beef CC impacts can be achieved by using 3-NOP in the cow's feed rations, and by reducing the population of suckler cattle in favour of more dairy cattle.