Greenhouse gas emissions of organic and conventional dairy farms – results from a pilot farm network in Germany

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In 2009, a network of paired organic and conventional dairy farms in various climatic and soil regions in Germany was started within the project 'Climate effects and sustainability of organic and conventional farming systems' (www.pilotbetriebe.de). This abstract presents some key results in regard to greenhouse gas (GHG) emissions of milk production. The farm model REPRO was used to calculate complete GHG balances of 34 farms. Total GHG emissions of milk production at the farm gate were (mean (min-max)) 983 (835–1397) and 1047 (911–1248) g CO_{2eq} kg^{-1} energy corrected milk (ECM) for organic (n=16) and conventional farms (n=18), respectively. The values were rather farm individual and means did not differ. Product related GHG emissions declined with increasing milk yields up to approximately 9000 kg ECM cow^{-1} a^{-1} and reached a plateau at milk yields beyond that level. The results confirm the importance of methane (CH_4) emissions from enteric fermentation in dairy cows as the main source of GHG emissions. REPRO estimated enteric CH_4 emissions based on daily dry matter intake (Ellis et al., 2007). As feeding practices of dairy cows differ between organic and conventional farming, enteric CH_4 emissions from cows were additionally estimated by taking results of feedstuff analysis of the pilot farms into consideration (Kirchgeßner et al., 1995). These values were on average 0.11 kg CO_{2eq} kg^{-1} ECM higher than those based on Ellis et al. (2007). Apart from feeding, milk yield is also influenced by cow health and welfare, thus affecting product related GHG emissions. Hence, cow welfare was determined on all pilot farms in the course of the ongoing project by applying the Welfare Quality® assessment protocol for cattle. In a preliminary study with four pilot farms, scenarios to improve cow health and welfare (e.g., by introducing pasture to dry cows) on environmental burdens and resource efficiency were calculated. Overall, effects on GHG emissions per kg ECM were relatively small (-5 to 2.6 %). Simultaneously considering animal related parameters, management procedures, and environmental performance of production provides an innovative possibility to address different sustainability goals on whole farm level and to approach win-win solutions. Advisory tools to perform individual calculations of GHG emissions in crop production and to evaluate cow welfare in farms were made available to the public. Currently, the scientific work within the network is being completed.

Keywords: modelling, methane, organic, conventional, animal welfare

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