Dietary Concentrate Supplementation Increases Milk Production and Reduces Greenhouse Gas Emissions Intensity in Pasture-based Commercial Dairy Farms

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ABSTRACT
Controlled studies have comprehensively documented that concentrate supplements usually increase total dry matter intake (DMI), milk yield, and enteric methane emissions (CH_4), whereas it reduces emissions per unit of milk produced and DMI. However, no study has been conducted to determine the effect of concentrate on enteric CH_4, manure CH_4, and nitrous oxide (N_2O) emissions from commercial pasture-based dairy farms. Thus, this study sought to determine how dietary concentrate supplementation affects enteric and manure CH_4, and N_2O of Australian pasture-based dairy farms. The Australian Dairy Carbon Calculator was used, which incorporates emission factors and methodologies used in the National Greenhouse Gas Inventory as reported to the International Panel on Climate Change. Primary data were collected and analysed from 120 commercial farms in Australia's major dairy regions (New South Wales, Tasmania, South Australia, and Victoria). Then the farms were divided into four groups based on their dietary concentrate supplementation: ≤ 1 (low), 1-2 (moderate), 2-3 (high), and ≥3 (very high) t DM/cow year. Sources of greenhouse gas (GHG) emissions were CO_2 from concentrate production, enteric CH_4, and manure CH_4 and N_2O. Total DMI, milk yield, and daily enteric CH_4 production (g/day) quadratically increased ($P < 0.01$) with concentrate level, whereas GHG emission intensity of milk production (kg CO2eq/kg fat and protein corrected milk) and yield (g CO_2eq/kg DMI) decreased by 14 and 4%, respectively. The CH_4 emissions from manure and N_2O emissions quadratically increased ($P < 0.05$) with increasing concentrate supplementation. The N2O and CH4 emissions from manure increased with increasing concentrate supplementation. In conclusion, increasing dietary concentrate supplementation for dairy cows resulted in increased milk production per cow and reduced GHG emissions per unit of milk produced. However, a comprehensive life cycle assessment study is needed to account for carbon sequestration by other farm components such as pastures and trees.
Keywords; Dry matter intake, Milk yield, Methane, Nitrous oxide