Methane Emissions from Grazing Dairy Cows in Victoria

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Methane is a potent greenhouse gas associated with global climate changes. Ruminant livestock are the largest source of methane in Australia. In cattle, methane is produced naturally as a by-product of digestion that is eventually breathed out, eructated or passed in the flatus. Methane production in cattle is also associated with loss of productivity, therefore strategies to mitigate methane emissions from cattle are desirable for both environmental and production reasons. Prior to investigating such mitigation strategies in Victoria, methods need to be established for measuring methane emissions in free-grazing cows. Such techniques exist overseas but have not been commissioned for use on dairy cattle in Australia. Local information concerning levels of methane emissions from cows is also needed to assess the accuracy of current greenhouse gas accounting methodologies.

Eight Holstein-Friesian cows of mixed-age were selected for study from the experimental herd at DPI Ellinbank. Throughout the experiment, cows grazed pasture as their main feed source when possible: when necessary, pasture was supplemented with grain and conserved forage. Methane emissions were measured using the technique described by Lassey *et al*. (1997). Briefly, this method involves placing a brass permeation tube into the rumen of each cow, which releases the marker gas sulphur hexafluoride (SF_6) at a known rate. A vacuum-filled canister is then strapped to the neck of the cow, which continuously samples the gas in the breath of the cow via a tube positioned over the nose with a leather halter. The breath sample is analysed by gas chromatography for concentrations of both SF_6 and methane. The amount of methane produced is calculated from the methane:SF_6 ratio (as the release rate of SF_6 is pre-determined from consecutive weighings before insertion into the animals). In the current experiment, the vacuum canisters were changed every 24 hours for 5 consecutive days on each sampling occasion. There were 4 sampling occasions at approximately 3 month intervals during the year. For the final sampling, a different group of 8 cows was used because the SF_6 in the original permeation tubes was nearly fully discharged.

Table 1. Means, minimum and maximum values, and standard deviations of daily methane emissions, mean milk yield and methane:milk ratios of grazing dairy cows at 4 times of the year

	Methane emissions (g/cow.day)				Mean milk yield kg/cow.day	Methane/milk Ratio (g/kg)
	Mean	Min	Max	Std Dev		
November	487	327	609	106.0	24.2	20.2
February	623	494	755	82.7	17.8	35.4
May	521	367	724	107.9	14.5	36.8
September	344	240	470	69.8	28.0	12.9

These data are the first published measurements of methane emissions from grazing, lactating dairy cows in Australia. Absolute levels of emissions were higher for cows in the current experiment (Table 1) than has been reported for grazing dairy cows in New Zealand (Roberston and Waghorn 2002), possibly because Victorian cows are generally heavier and higher yielding. Emissions were variable both between cows across the year (variance component analysis indicated >50% of the observed variation was accounted for by time of sampling). Emissions appeared higher in summer and late autumn than in early and late spring. This may be related to differences in diet quality and level of feeding, since, in summer and autumn, the availability of lush fresh pasture was lower. In Table 1, milk yield is presented as a surrogate measure of dry matter intake (DMI). Methane produced per unit milk (and therefore per kg DMI) also varied across the year, pointing to the potential for mitigation of methane emissions via dietary manipulations. Further research will now focus on developing on-farm technologies for reducing methane emissions from the Victorian dairy industry.

This research was funded by the Victorian Department of Primary Industries and the Victorian Greenhouse Strategy.

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