Tellus (1993), *45B*, 86–88

Methane production by sheep and cattle in Australia

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(Manuscript received 3 April 1992; in final form 5 June 1992)

ABSTRACT

Using methane production rates from Australian feeds and local estimates of the quantity of feed eaten by different classes of animal, it was estimated that sheep and cattle in Australia produce 2.66 Tg methane in 1990. This value is 43 % higher than previous estimates and indicates a need to reassess the methane production of ruminants in other countries.

In the past 140 years the concentration of methane in the atmosphere has more than doubled and in future may increase at a rate of 1 % per year (Hogan et al., 1991). This rise in concentration of methane is considered to have important effects on world climate; one kg of methane has 21 × the global warming potential (over the next 100 years) as a similar quantity of carbon dioxide (IPPC, 1990).

It has previously been calculated that the large flocks of sheep and herds of cattle in Australia produce 1.90 Tg (Lerner and Matthews, 1988) or 1.86 Tg (Williams, 1990) of methane each year, equal to about 1/3 of the total methane emitted from all sources in Australia and 2.5 % of the total world production of methane from domestic ruminants (Lerner and Matthews, 1988). These estimates of methane production by domestic ruminants were mainly based on methane yields of ruminants in Europe and North America (Crutzen et al., 1986) where grain is fed in large quantities. By contrast, most Australian ruminants rely on pasture, often of low quality with little, if any, grain feeding. It was therefore decided to re-examine the methane production of Australian ruminants using methane production rates from Australian feeds and local estimates of the quantity of feed eaten by different classes of animal.

Methane production from a wide range of temperate and tropical forages have been determined by CSIRO at the Ian Clunies Ross Animal Research Laboratory. From this data, it has been possible to calculate the quantity of methane produced per unit of dry matter consumed. Methane production fell as the quantity of feed eaten was increased (Table 1). A similar effect of level of feeding on methane production was found with one sample of *Medicago sativa* hay fed at the University of New England (Murray et al., 1978). This decrease in methane production per kg dry matter is probably caused by a reduction in the time forage is exposed to microbial breakdown in the rumen and/or to a decrease in rumen pH (Minson, 1990).

The total quantity of food eaten by each class of stock was calculated from an average weight of the animals estimated by animal scientists in 3 states, the average level of production, the nutrients required to meet the needs of these animals and the total number of sheep, beef cattle and dairy cattle in Australia (Table 2).

Estimated methane production in Australia in 1990 was 2.56 Tg. This is probably an underestimate of the actual production since the animal numbers quoted by the Australian Bureau of

Table 1. *Effect of level of feeding on mean methane production by sheep from Australian feeds*

Level of feeding	Number of samples	Methane production (g/kg DM)
maintenance	15	22.7
2 × maintenance	8	19.7
3 × maintenance	3	15.1

Derived from the data in references (Graham 1964 a, b, c, 1967, 1969, Margan et al., 1985, 1986, 1988). Animals were considered to be at the maintenance level of feeding when neither gaining nor losing energy.

Table 2. *Methane production of domesticated ruminants in Australia*

Means for herd/flock	Sheep	Beef cattle	Dairy cattle
weight (kg)*	45	344	438
liveweight gain (g/day)**	20	400	400
wool (g/day)	13	—	—
milk (l/day)	—	—	6.8
assumed DM digestibility (%)	65	60	70
estimated DM intake (kg/day)+	1.029	6.600	9.700
intake as a multiple of maintenance intake	1.54	1.50	2.44
estimated methane (g/kg DM)++	21.1	21.2	17.7
methane produced (kg/animal/year)+++	7.92	51.07	62.67
number animals (31 March 1990)	170,297,000	20,688,000	2,523,000
total methane Tg/year	1.349	1.057	0.158
grand total Tg/year		2.564	

* Estimated by 9 scientists in New South Wales, Queensland and Victoria.

** Australian Bureau of Statistics (1990). Killing-out assumed to be 50% and only half the sheep passed through abattoirs.

+ Minson and McDonald (1987), Standing Committee on Agriculture (1990).

++ Estimated from Table 2 assuming that these methane production rate obtained with sheep can also be applied to cattle.

+++ Previous estimates of methane production in Australia assumed that sheep and cattle produced 5 and 55 kg/animal/year respectively (Crutzen et al., 1986).

Statistics (1991) are for properties with a gross income >$20,000 pa but approximately 2% of sheep and 6% of cattle are on properties with gross income between $5,000 and $20,000 (Australian Bureau of Statistics, 1990). When allowance is made for animals on these smaller properties the estimated methane production in Australia is increased to 2.66 Tg. This may still be an underestimate of methane production since sheep data was used to predict the methane production from feeds eaten by cattle (Table 1). Data in one study showed that when consuming hay, methane production (g/kg DM) was 15% higher for cattle than sheep (Blaxter and Wainman, 1964). This result is consistent with the higher digestive efficiency of cattle and the longer time feed is subjected to microbial degradation in the rumen of cattle (Minson, 1990). If this difference is confirmed by further work then my estimate of methane production in Australia will have to be increased by an additional 0.20 Tg.

In conclusion it is suggested that the quantity of methane produced by sheep and cattle in Australia is at least 2.66 Tg, or 43% higher than previous estimates and that in view of this discrepancy there is a need to reassess the methane production of ruminants in other countries.

Acknowledgments

I wish to thank Bob Armstrong, Janet Foot, Jamie Graham, John Moran, Alan Murray, Ken Phillips, Geoff Robards and Tom Rudder for supplying estimates of animal weights and Mike Freer, Mark Howden and Dennis Margan for supplying other data used in this paper. This communication is based on a paper presented to a meeting on "Greenhouse Impact on Rural Industry" and I thank the Queensland Branch of the Australian Institute of Agricultural Science for permission to publish this paper.

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Printed in Belgium