Methane production by cattle grazed at two stocking rates on a semi-natural grassland

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Introduction Global warming induced by the human-enhanced concentrations of greenhouse gases (GHG) in the atmosphere is a major environmental concern of our day. Enteric methane (CH_4) is the most important GHG associated with grazing livestock. The emissions of methane may be influenced by environmental conditions and grazing management. Stocking rate (SR), the number of animals per unit of land area, remains the simplest management tool in pastoral farming. However, little is known about the influence of SR on CH_4 emission. The objective of this study was to compare the CH_4 emissions from cattle managed under low and high SR.

Materials and methods The study was conducted during the 2002 and 2003 grazing seasons on a 6.7 ha semi-natural grassland (Massif Central, France; 1250 m altitude). The area was subdivided into two paddocks and continuously grazed under low (LSR: 1.1 livestock units (LU)/ha) or high (HSR: 2.2 LU/ha) SR, each involving seven 20-months-old Holstein-Friesian heifers (initial body weight: 442±28.5 kg in 2002 and 451±44.5 kg in 2003). The study comprised four experimental periods: late spring (P1), mid summer (P2), late summer (P3) and early autumn (P4), each comprising a 6-d acclimatisation period (d 1 to 6), followed by an 8-d (d 7 to 14) sample collection period. Feed organic matter intake (OMI, kg/d) by individual cows was calculated using their mean faecal OM output (kg/d) and OM digestibility (OMD) estimations. Daily CH_4 productions were determined using the sulphur hexafluoride (SF_6) tracer technique.

Results In both grazing seasons SR treatments did not differ in daily CH_4 production (g/d) (Table 1). However, the rate of CH_4 emission per unit of digestible OMI (g/kg DOMI) was lower in the HSR system than in the LSR system (Table 1). The latter was probably due to the differences between systems in feed OMI and OMD (both higher in HSR), suggesting that the high herbage mass observed in the LSR system had adverse effects upon OMI and OMD. There was no clear pattern of period (P) effects upon CH_4 emission in either grazing season.

Table 1 Effects of stocking rate treatments (T; LSR and HSR), periods (P) and T×P interaction on CH_4 emission by heifers, expressed as g/d or g/kg digestible OM intake (DOMI)

Periods	P1	P2	P3	P4	s.e.m.	T	P	T × P
			Grazing season 2002					
g/d	224.7*ac*	237.6*a*	204.4*c*	263.2*b*	8.0	ns	***	ns
g/kg DOMI								
LSR	32.0*aA*	41.3*bcA*	47.7*cA*	38.3*abA*	2.6	ns	ns	***
HSR	40.7*aB*	31.0*bB*	34.1*abB*	35.3*abA*				
			Grazing season 2003					
g/d								
LSR	162.7*aA*	208.5*bA*	213.1*bcA*	229.2*cB*	6.6	ns	***	**
HSR	176.6*aA*	215.5*bA*	207.8*bA*	199.4*bA*				
g/kg DOMI								
LSR	36.5*a*	40.3*a*	37.0*a*	36.9*a*	2.9	*	**	ns
HSR	33.6*a*	39.2*a*	29.3*ab*	22.4*b*				

a–c, means within a row which do not share a common letter are significantly ($P < 0.05$) different
A,B, means within the same column with different letters are significantly ($P < 0.05$) different
*, **, ***, ns indicates statistical significance (*, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$; ns, not significant)

Conclusion The results of this study are in general agreement with those found by McCaughey *et al*. (1997) and suggest that SR effects upon CH_4 emission should be evaluated on the basis of animal production efficiency.

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Reference

McCaughey, W.P., K. Wittenberg & D. Corrigan (1997). Methane production by steers on pasture. *Canadian Journal of Animal Science*, 77, 519-524.