

The Stimulatory Effect of the Organic S Compound, Mercaptopropanesulfonic Acid on Rumen Function in Cattle

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Provision of S to animals fed low S tropical grasses has resulted in improvements in intake, fibre digestion and rumen fungal numbers (Rees and Minson 1978; Morrison *et al.* 1990). It was reported that fungal populations could be selectively stimulated with organic sources of sulfur (e.g. 3-mercapto-1-propanesulfonic acid, MPS) which may be preferentially utilised by anaerobic rumen fungi (ARF) (Phillips and Gordon 1991). Two metabolism trials (experiments 1 and 2) were conducted to examine the effect of MPS on feed intake, fibre digestibility, rumen function and abundance of cellulolytic rumen microorganisms in cattle fed low S (< 0.11%) roughages. Microbial populations were quantified by real-time PCR (Denman and McSweeney 2006). Microbial protein flow from the rumen was estimated by the urinary purine method (Chen *et al.* 1990).

In experiment 1, steers (333 ± 9.5 kg liveweight) were fed Angleton grass (*Dicanthium aristatum*) supplemented with S in equivalent amounts as either MPS (6.0 g/d) or sodium sulfate (9.56 g/d) while in experiment two, heifers (275 ± 9 kg liveweight) were fed rice straw and twice the amount of S was provided as MPS (8.0 g/d) compared with sulfate (6.6 g/d). Supplementation of Angleton grass with either sulfate or MPS resulted in an apparent increase in flow of rumen microbial protein (30-37%) from the rumen. Sulfur supplementation did not significantly change whole tract dry matter digestibility or intake even though sulfate and MPS supplementation was associated with an increase in the relative abundance of the fibrolytic bacteria *Fibrobacter succinogenes* and anaerobic rumen fungi. In experiment 2, MPS supplementation resulted in an increase in concentration of both short- and branched-chain fatty acids, and ammonia utilisation compared with sulphate even though S and N were above requirements for growing cattle in both MPS and sulphate treated groups (Table 1). These responses in heifers fed rice straw occurred without a change in feed intake or fibre digestibility.

In conclusion, supplementation of a S deficient low quality roughage diet with either MPS or sodium sulfate improved rumen function through an increase in microbial protein synthesis. However MPS appeared to have a greater effect on stimulating short-chain fatty acid production and ammonia utilisation when provided at higher concentrations than sulfate. Thus the metabolism of MPS in the rumen needs to be investigated further in comparison with inorganic forms of S since it may prove to be more effective in stimulating fermentation of roughage diets.

Table 1. Effect of sulfur supplements on ruminal fermentation characteristics in heifers fed rice straw (experiment 2)

	Control		Sodium sulfate		MPS	
	0 h	6 h	0 h	6 h	0 h	6 h
pH	7.2 (0.1)	7.2 (0.1)	7.3 (0.1)	7.3 (0.1)	7.2 (0.1)	7.5 (0.2)
NH ₃ N (mM)	2.7 ^a (0.4)	8.2 ^a (0.9)	3.1 ^a (0.2)	8.1 ^a (1.1)	2.0 ^{b*} (0.3)	5.4 ^{b**} (0.4)
TVFA (mM)	42 (5)	70 ^a (6)	43 (3)	65 ^a (4)	33 (4)	89 ^{b*} (3)

Values in rows with different superscripts vary significantly at the respective time.

SEM given in parenthesis. * (P<0.05), ** (P<0.01)

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