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A. Adepoju

F. Portela

B.E. Brent

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Protein synthesis in the rumen: Ruminal urease inhibition by acetohydroxamic acid

Abstract

When urea is fed to ruminants, it is immediately converted to ammonia by an enzyme, urease. The ammonia usually becomes available faster than rumen bacteria can convert it to protein. Studies were reported last year (Bulletin 518) on attempts to slow down, or inhibit urease with acetohydroxamic acid. This year effects of acetohydroxamic acid on rumen ammonia, and volatile fatty acid levels in both sheep and cattle have been studied. In both, rumen ammonia was depressed for about 4 hours after feeding, and rumen fluid urea levels were increased, showing that urease was inhibited. Ammonia data for the steers showed no cumulative effect from prolonged use of acetohydroxamic acid, and no residual effect when it was withdrawn from the ration.

Keywords

Cattlemen's Day, 1969; Report of progress (Kansas State University. Agricultural Experiment Station); 529; Beef; Protein; Urease; Acetohydroxamic acid

Protein Synthesis in the Rumen: Ruminal Urease Inhibition by Acetohydroxamic Acid (Project 596)

Amos Adepoju, Fabio Portela and B.E. Brent

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Volatile fatty acid concentrations and patterns for steers and lambs indicated the inhibitor had no effect on carbohydrate metabolism in the rumen.

Ration digestibility was studied in sheep, using 0, 120, or 240 mg. acetohydroxamic acid (AHA) per feeding. Ration composition is shown in table 3 . Digestion data, total digestible nutrients (TDN) and nitrogen balance are shown in table 4 .

The data show that AHA had little, if any, effect on ration digestibility.

Nitrogen balance indicates the amount of nitrogen converted to protein and used in body growth. Since AHA depressed nitrogen balance, urea apparently was absorbed unchanged through the rumen wall and excreted in the urine.

Table 3

Ration Composition[1]

Constituent	Percent
Corn	73.13
Prairie hay	25.00
Urea	1.27
Salt	0.37
Ground limestone	0.23

[1] The complete diet was finely ground and pelleted.

Table 4

Mean Digestibility
TDN[1], and Nitrogen Balance

	Control	120 mg. AHA per feeding	240 mg. AHA per feeding
Dry matter	74.66	72.30	73.67
Crude protein	71.21	70.21	71.28
Crude fiber	38.58	30.37	36.85
Ether extract	75.68	78.57	76.58
Nitrogen free extract (NFE)	82.56	80.76	81.71
TDN	76.21	74.28	75.52
N balance, gm/6 days	44.74	25.91	22.71

[1] Digestibilities and TDN values represent an average of 2 observations. Nitrogen balance is an average of 6 observations.

Summary

Acetohydroxamic acid (AHA) inhibits rumen urease but has no effect on ration digestibility. Because unhydrolyzed urea is rapidly absorbed and excreted, it seems unlikely that urea utilization efficiency can be increased by inhibiting urease.