RECYCLING OF UREA-N IN CATTLE ON A LOW-N BASAL DIET AND WHEN SUPPLEMENTED WITH PROTEIN

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The transfer of endogenous urea N to the rumen and its synthesis into protein by microorganisms is a means whereby ruminant animals reduce their dietary protein requirements (Houpt 1970). Despite their having this ability, cattle on the north coast of N.S.W. on dry native pastures have low rumen ammonia concentrations (< 10 mg N/l) which probably reduce microbial protein output from the rumen. However, no information on the extent of recycling of N to the rumen is available.

As part of a larger study of the protein nutrition of Hereford steers given low quality hay (5.8 MJ ME and 7.8 g N/kg DM), endogenous urea entry to the rumen was estimated in animals given only hay, or hay plus 600 g of protein pellets. Carbon (and thus N) transfers between plasma urea and rumen bicarbonate C were estimated according to a two-compartment model from the kinetics of intravenously injected [^{14}C]-urea and intra-ruminally injected [^{14}C]-bicarbonate (see Nolan et al. 1976). The results are given in Table 1.

TABLE 1 The effects of a protein supplement on urea synthesis in the body and its degradation in the rumen and whole digestive tract of cattle given low quality hay ad libitum. The protein supplement contained cottonseed meal, fishmeal, meatmeal (80:10:10) and minerals

	Basal diet	Basal diet & supplement	S.E.
N intake (g/d)	30	74	5**
ME intake (MJ/d)	22	31	3*
Rumen ammonia concentration (g N/L)	6	58	4**
Urea irreversible loss rate (g N/d)	16	44	8**
Urea degradation (rumen) (g N/d)†	9	19	4**
(total tract) (g N/d)	16	35	4**

* P < 0.05; ** P < 0.01; † Calculated assuming degraded urea gives rise to 1 mol bicarbonate and 2 mol ammonia.

In unsupplemented cattle, 98% of the urea produced in the body was degraded in the alimentary tract; 58% was degraded in the rumen. In protein supplemented cattle, the corresponding values were 80% and 40%. In unsupplemented cattle, whilst all but 2% of the urea synthesized entered the digestive tract, rumen ammonia levels were too low to support efficient microbial growth. In supplemented cattle, recycling of urea N, plus dietary N, increased ammonia to a level that was likely to be adequate for efficient microbial growth. Notwithstanding, endogenous urea entry to the rumen as a fraction of urea synthesis was reduced by supplementation suggesting that recycling of urea N was maximized in the unsupplemented steers. Thus dietary supplements appear to be necessary, and to be the only means of increasing rumen ammonia concentrations in cattle given pasture hay on the north coast.

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NOLAN, J.V., NORTON, B.W. and LENG, R.A. (1976). Br. J. Nutr. 35:127

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