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THE EFFECT OF INFREQUENT ADMINISTRATION OF UREA ON RUMEN AMMONIA AND SERUM LEVELS OF CATTLE CONSUMING RICE STRAW [1]

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Two experiments are reported in which urea was administered intraruminally either once or twice daily to cattle consuming a diet of rice straw for 12 hours each day. Rumen ammonia levels were above the suggested critical level for 5.6 and 8.3 hours in the two experiments following the single administration of urea and for a total of 8.2 hours following the split administration of urea. The benefit of urea fed as an infrequent supplement to cattle consuming low protein diets in Asia is discussed.

Key words: rice straw, urea supplementation, rumen ammonia, South East Asia, Thailand

While supplementary feeding of minerals or urea is usually recommended on a continuous basis, this is not possible in many Asian situations. Cattle in the grassland areas of northern Thailand, Burma, Lao-PDR, Vietnam and southern China graze native pastures dominated by *Imperata cylindrica* during the daytime and are yarded or herded overnight (Falvey 1977). Supplements can be more easily administered during the evening (after grazing) or during the morning (before grazing).

Once or twice daily supplementation with urea to low protein diets such as *Imperata cylindrica* (Falvey et al 1981) and rice straw would be expected to increase ruminant productivity when rumen fluid NH_3 - N is below 5 mg $100ml^{-1}$ (Satter and Slyter 1974) by producing high[3] concentrations of rumen NH_3 - N for periods of time sufficient to provide a reserve for continuing bacterial reproduction (Smith 1979).

The following studies investigated the effect of administering urea once or twice daily on the rumen NH_3 - N and serum urea levels of cattle consuming a low quality diet in Thailand.

Materials and Methods

Location: The experiments were conducted at the University of Chiang Mai, Thailand (latitude 19°N).

Experimental animals and feed: Native cattle fitted with rumen cannulae were kept in metabolism pens and provided a diet of rice straw (2.0g N kg DM^{-1}) ad libitum for 12 hours each day. Supplementary urea (25g day^{-1}) was administered as per the experimental designs.

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Experimental design: Two experiments were conducted. In experiment 1, a change-over design was employed to examine three regimes of urea administration using three animals. After a four day adaptation period, each animal was subjected to each treatment for one day. In Experiment 2 two cattle received the supplement while two cattle did not, for a period of ten days.

Supplement: Urea was administered intraruminally. In Experiment 1, the treatments were: (a) administration of 25g of urea immediately after removal of feed (designated at 0.0 h); (b) administration of 12.5g of urea immediately before presentation of feed (12.0h) and a further 12.5g of urea immediately after removal of feed (0.0 h), and (c) no administration of urea. In Experiment 2, the two supplemented animals received 25 g of urea immediately after removal of feed (0.0 h) while the other two animals did not receive any urea.

Rumen fluid: In Experiment 1, rumen fluid (30 ml) was collected under suction from those cattle receiving the single dose of urea at the times: immediately before administration of urea (0.0 h); 0.2; 2.0; 4.5; 8.0, 10.0 h and at 24.0 h over the last few days of urea administration. Rumen fluid was stored frozen until being analysed photometrically for NH_3 - N.

Serum urea: In Experiment 2, blood was collected by bleeding at the tail vein approximately every hour up to 10.0 h and 24.0 h over the last four days of urea administration. Serum was stored frozen until being analysed photmetrically for urea.

Results

Experiment 1: The mean rumen fluid NH_3 - N levels of the three urea treatments are presented in Figure 1. No interactions between treatments as a consequence of the change-over design were observed. NH_3 - N levels in the rumen fluid of cattle receiving the single dose of urea were significantly higher ($P < 0.05$) than those of the control group for the times 0.2; 2.0 and 4.5 h but not significantly different ($P > 0.05$) after 8.0 h. In the case of the split dose of urea, NH_3 - N levels were significantly higher ($P < 0.05$) than those of the control after the 0.0 h administration of urea for the times, 0.2 and 2.0 h and after the 12.0 h administration for the times 12.2 and 14.0 h.

Experiment 2: Rumen fluid NH_3 - N and serum urea levels for the two treatments are presented in Figure 2. Rumen fluid NH_3 - N in the cattle receiving the urea supplement was significantly higher ($P < 0.05$) than that of cattle in the control group for the times: 1.0; 2.0; 3.0; 4.0;5.0; 6.0 and 7.0 h. Serum urea levels of cattle receiving urea were significantly higher ($P < 0.05$) than those of the control group for the times: 3.0; 4.0; 5.0; 6.0; 7.0 and 10.0 but not 24.0 h.

Figure 1:
Rumen fluid ammonia-nitrogen levels from Experiment 1 after one dose of urea (····), two doses of urea (---) and no dosage (——)

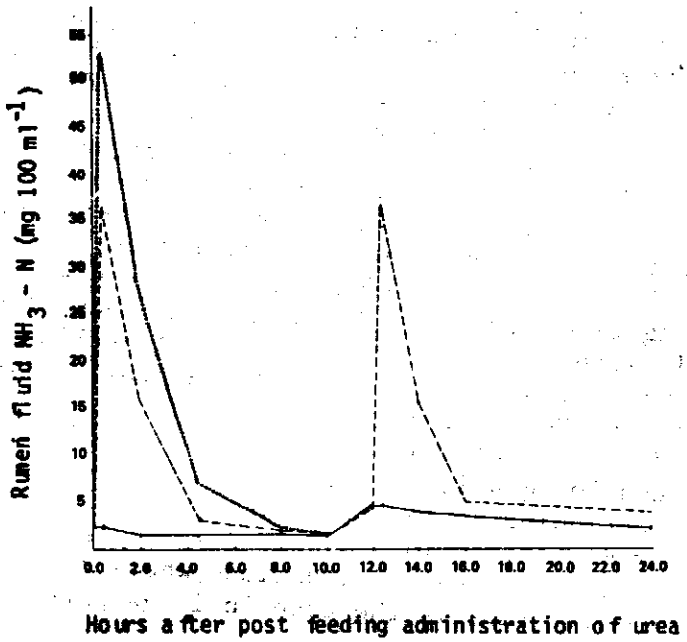
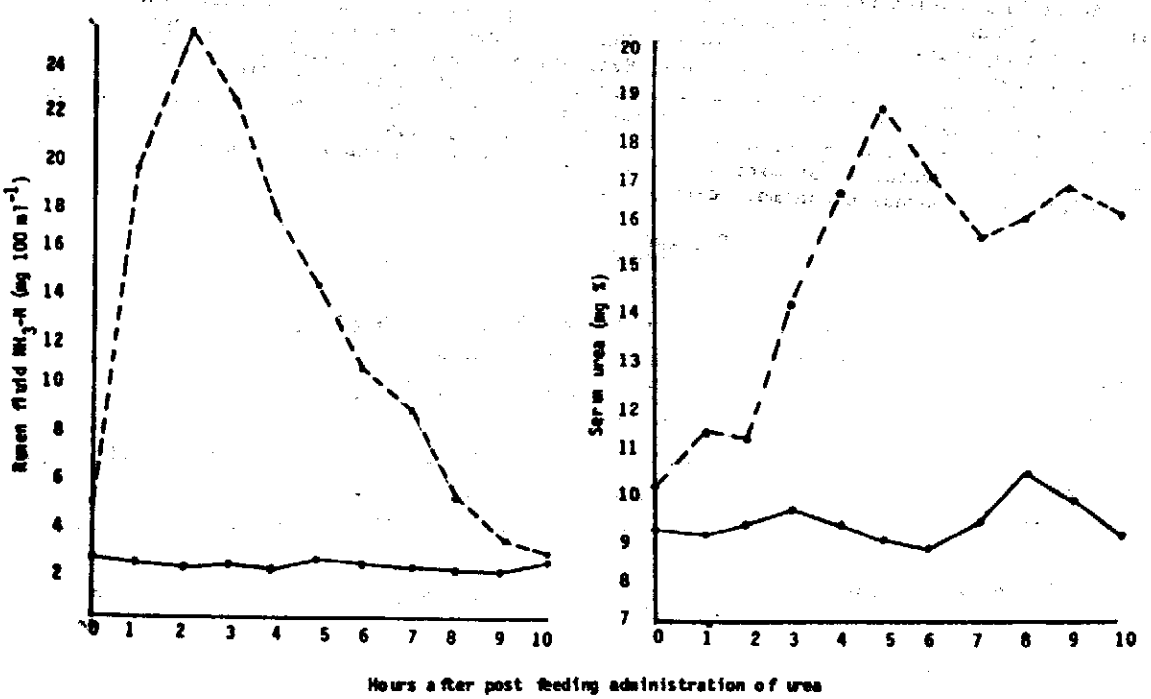


Figure 2:
The effect of urea administration on rumen fluid ammonia and serum urea over time from one dose (-----) and no dosage (——)



Discussion

Administration of urea in a single dose effectively raised rumen fluid NH_3 - N above that of unsupplemented animals in both experiments. If the figure of 5.0 mg NH_3 - N 100 ml^{-1} is accepted as the limit below which microbial fermentation is inhibited (Satter and Slyter 1974), then the period of benefit from the urea supplements lasted an average of 5.6 and 8.3 hours in Experiments 1 and 2 respectively for the single dose and for a total of 8.1 hours for the split dose of urea in Experiment 1. These periods of time are shorter than those recorded by Perez et al (1967) from administration of 20 g of urea to sheep that were not provided with feed or water before or after drenching. The lower levels of ingesta in the digestive tract and consequently slower rates of movement of rumen contents out of the rumen may account for the differences.

Serum urea levels remained high for the group receiving urea until the last sampling time each day (10.0 hours) although levels did not differ significantly after 24.0 hours. The rate of decline over this period cannot be determined from this study, but a linear decline may be postulated from the data of Perez et al (1967).

It is concluded that single daily administration of urea to cattle allowed access to such low quality diets on a restricted basis is of benefit as a pool for continuing bacterial growth (Smith 1979). While the utilization of urea administered in a single dose is less efficient than continuous intake, it is of value in situations where continuous supplementation is impractical. This is the case in large parts of South East Asia.

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