Cattle in pens were offered over 49 days a basal diet of low quality hay made from a native pasture that is typical of many of the pasture types of north-coastal New South Wales. Urea was sprayed onto some of the hay and fed to the cattle to give incremental amounts of urea from 0-53 g/head/day; one other group was supplemented with water-sprayed hay and a protein supplement (400 g/head/day).

Cattle without either of the nitrogen supplements consumed only 2.53 ± 0.14 kg hay/day and lost weight (50 g/day). When supplemented with urea, hay intakes were increased to 3.0 ± 0.13 kg/day and cattle gained weight (160-270 g/day). The differences in liveweight between groups supplemented with different levels of urea were not significant. Cattle supplemented with protein had increased intakes of hay (3.1 ± 0.15 kg/day) the largest weight gains (390 g/day) of any cattle, which although not significantly different from three of four urea-supplemented groups, could indicate that they used ingested nutrients more efficiently than urea-supplemented cattle.

INTRODUCTION

The north coast of New South Wales contains (1981/82) 18% of the state’s beef herd and therefore is an important beef producing region in the state. However, most of the cattle graze native or unfertilized pastures which grow only during the humid summer season. During the winter, due to the effects of frosts and rain, grazing cattle are faced with a basal diet of very low quality (34% digestibility and 0.4% N; Cohen 1978). Although available energy and nitrogen contents of the pastures are low, only supplements of high-protein meals have improved production (Cohen 1976; Hennessy et al. 1981; Hennessy 1983). Supplements of molasses, or urea plus molasses, or urea licks did not improve cattle production on native pastures (Cohen 1974, 1976; Want and Mears 1980). These findings contrast with those of Winks et al. (1979), Leibholz and Kellaway (1980) and McLennan et al. (1981) who found either live weight or intake of the basal diet was improved when urea was added to a molasses supplement, or to the basal diet.

The objective of the experiment reported here was to measure the feed intake and liveweight of young steers when offered a basal diet of low quality pasture hay alone or when supplemented with either increasing amounts of a urea-sprayed hay, or a single supplement of a protein meal.

MATERIALS AND METHODS

Animals

Eighteen Hereford steers and heifers, nine months-of-age and a live weight of 148 ± 6 kg were stratified into three groups based on live weight, and allocated randomly from a stratum to any of six treatments with the restriction that each final group would contain both sexes.

Feedstuff and preparation

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The basal hay diet had a digestibility (OM basis) of 43 ± 3\% and contained 7.8 g N/kg DM. The hay was chaffed into 25 ± 8 mm lengths and placed into plastic bags in sufficient quantity for a 7-day feeding period. Some of the hay was sprayed with a urea solution (40\% w/v urea) and an equal amount sprayed with water. These batches of hay were placed on a concrete apron and sun dried for 10-20 min to equilibrate the DM content of the hay to that of the unsprayed hay (viz. 89\%). Urea-sprayed hay contained 19.4 ± 2 g N/kg DM, indicating 25 g urea/kg DM remained on the hay.

Composition of the protein pellets (Agrafpel 80) was described previously, (Hennessy et al. 1983). In brief, they contained 63 g N/kg DM with a digestibility of 69\%.

Treatments and feeding regimen

There were six treatments; a basal hay diet (A), four levels of urea intake (B-E) and one group (F) given a supplement of 400 g/animal/day of protein pellets. Urea intakes were planned to be 30, 60, 90 and 120 g/animal/day.

Uneaten hay was removed from each animal's feed bin by 08.00 h and bulked over 7 days for each animal. Each animal was then offered urea, or water-sprayed hay with additions of unsprayed hay at 13.00 h and when required at 15.00 h or 18.00 h each day. All animals, with the exception of those in group F, were offered a complete mineral supplement (45 g/animal/day) which was sprinkled on top of the hay.

Those in group F, were offered 400 g of protein pellets that contained added minerals in two feeds, each of 200 g, at 09.00 h and 13.00 h. The composition of the minerals in the pellets was similar to that given steers on the basal and urea hay diets. An estimated 20 g/day was supplied by the pellets.

(i) Rumen samples. These were taken before feeding on five occasions during the 49 day experiment by aspirating 25 mL of liquid from the rumen, through a length of rubber tubing (3 m x 12 mm O.D.), into a bottle containing 2 mM sulphuric acid. The samples were centrifuged and the supernatant fluid removed and stored at −10°C pending analysis. Ammonia concentration on decanted fluid was determined by steam distillation and titration.

(ii) Feed analyses. The dry matter (DM) content of samples of hay and protein meal was calculated from the loss of mass upon drying for 24 h at 70°C; and organic matter (OM), from the loss of mass after igniting at 450°C over 4 h.

(iii) Live weight. The live weight of cattle was recorded on days 0, 30 and 45 of the experiment after feed and water were removed for 16 h. Estimates of live weight change (g/day) were calculated by regression.

RESULTS

(i) Urea intake. Intake of urea from the sprayed hay was less than that proposed. Mean intakes for the groups offered urea were 15 ± 1.5, 23 ± 2.7, 41 ± 3.8 and 53 ± 4.4 g/day.

(ii) Live weight. Cattle on the basal hay diet lost weight (50 g/head/day) whereas all supplemented cattle gained weight. These gains were significantly (P<0.01) different from the loss occurring in unsupplemented cattle, for all groups, except D (41 g urea/day; 160 g/head/day liveweight gain, Fig. 1). Cattle offered protein pellets had the highest rate of gain (390 g/head/day) which was different (P<0.01) from the gain of cattle in group D, and the loss in cattle of group A.
Feed intake. Intake of hay was greater ($P<0.01$) in supplemented cattle (3.03 ± 0.1 kg DM/day) than in unsupplemented cattle (2.53 ± 0.14 kg DM/day): differences were not significant between cattle on different urea intakes (3.0 ± 0.13 kg DM/day) or when offered protein pellets (3.1 ± 0.15 kg DM/day).

Rumen ammonia. The mean concentration of ammonia in rumen fluid was increased significantly ($P<0.01$) by urea supplements. Concentrations were low in cattle on the basal diet (7.5 mg NH$_3$-N/L) and raised by protein pellets to 45 mg NH$_3$-N/L although not significantly. Concentrations increased linearly from 54 to 152 mg NH$_3$-N/L with increases in urea intake.

**DISCUSSION**

A feature of the matured grasses that characterize the grassland areas of the sub-tropics during winter is their low digestibility and low content of N which have been attributed as the causes of weight loss in cattle (Cohen 1978). Certainly, according to the criterion used by Satter and Slyter (1974), a rumen concentration of 7.5 mg NH$_3$-N/L is far below the desired level (50 mg NH$_3$-N/L) which they considered necessary for a maximum production of microbial protein, commensurate with the available energy. In our experiment, urea, when sprayed onto hay, and consumed by steers, increased rumen ammonia concentration, feed intake, and liveweight gain. Based on these parameters, protein supplements appeared to offer no significant advantage during the 49-day trial. The success of urea must be attributed to the form of presentation and the duration of ingestion (see Tudor and Morris 1971; Romero, et al. 1976) since in a field trial (Want and Mears 1980) where ingestion was irregular, or in a pen trial (Cohen 1974), where urea was offered in a single dose, no significant responses were recorded in either feed intake or live weight.
The conclusions from this study agree in essence with those made by Kellaway and Leibholz (1981) in that urea is an effective source of N for cattle when given frequently and when the basal diet contains little N that is degradable. It is not apparent why cattle on diet D (41 g urea intake/day) did not gain weight at a rate similar to the cattle on the other urea diets, since all urea-supplemented cattle had rumen ammonia concentrations above 50 mg N/L, whenever sampled. On the other hand, rumen ammonia concentrations (45 mg N/L) were less than optimum (50-80 mg N/L) in protein supplemented cattle (diet F), yet hay intake increases were similar, in these cattle, to increases in the urea-supplemented cattle. The difference between the two types of supplements may be due to either or both of the following operating in protein supplemented cattle: a more effective recycling of plasma urea, especially through the rumen wall; the provision of essential amino acids at the small intestine which overcame a specific deficiency limiting production. The results, therefore in common with those of Lindsay and Loxton (1981), indicate a possible specific benefit of bypass protein which acts beyond the rumen in cattle on low quality hays. For these reasons, protein supplements alone, or in combination with some urea would seem to be the most appropriate N supplement for grazing cattle especially when intermittent or irregular intakes apply.

REFERENCES


