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EFFECT OF BIURET, GRAIN AND MINERAL MIXTURE ON THE INTAKE AND LIVEWEIGHT PERFORMANCE OF WEANER STEERS

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SUMMARY

In two pen-feeding experiments, commercial Brahman x Shorthorn steers, fed a basal diet of either rice straw or native pasture hay, were supplemented with 142 g grain per head per day; 71 g biuret per head per day; grain plus biuret; grain plus biuret plus mineral mix (2 g Na, 5 g P, 3 g S per head per day); or biuret plus mineral mix.

Feeding biuret significantly ($P < 0.05$) improved liveweight performance, but the addition of grain to the biuret failed to give any additional response. Inclusion of a mineral mix with the biuret with or without grain reduced the adaption period as judged by increased roughage intake from 7 weeks to 3 weeks.

I. INTRODUCTION

Cattle grazing native pasture in north Queensland lose weight during the dry season as pasture quality declines (Alexander and Chester 1956). These pastures have been shown (Playne and Haydock 1972) to contain levels of nitrogen, phosphorus, sodium and sulphur which would be inadequate for a maintenance diet for cattle at that time. A significant improvement in liveweight performance of weaner cattle fed a supplement of molasses-urea has been shown by Winks, Alexander and Lynch (1970), but addition of phosphorus gave no extra benefit (Winks and Laing 1972). Kennedy and Siebert (1972) showed that supplemental sulphur was necessary where non protein nitrogen was fed with low quality roughage and Siebert and Kennedy (1972) showed that additional sodium and phosphorus did not appear essential.

In the experiments described, the effects of supplements of biuret, grain and the minerals P, Na and S on the feed intake and liveweight performance of steers fed a ration of rice straw and native pasture hay are examined.

II. MATERIALS AND METHODS

FEEDSTUFFS. The rice straw and native pasture roughages were cut at Millaroo, 110 km south of Townsville. The roughages were grown on an Oakey–Baratta complex soil (Christian *et al* 1953). Harvesting was carried out by mowing after maturity with a rotary slasher. The mown material was raked into windrows and when sufficiently dry was baled with a pick-up baler. The botanical composition of the native pasture roughage as determined by the method of t' Mannetje and Haydock (1963) was as follows—*Heteropogon contortus* (black spear grass) 53·6%; *Bothriochloa intermedia* (forest blue grass) 20·8%; *Dicanthium* spp. (blue grass) 18·3%; *Thermeda australis* (kangaroo grass) 3·6%; and *Panicum* spp. 0·1%.

Feed-grade biuret (42% N) and locally grown grain sorghum (*Sorghum vulgare*) were used. The mineral mix was designed to supply 2 g Na from sodium chloride, 5 g P from defluorinated rock phosphate (31·5% Ca, 18% P) and 3 g S from elemental sulphur per head per day.

Clean drinking water was readily available to the steers 24 h a day. In experiment 2, the quantity of water consumed per head per day was calculated daily by difference.

YARDS. The experiments were carried out in yards each of similar design with a minimum of 4·6 m^2 per head. Water was available in each yard but shade was available only in experiment 1. The yards had a strip 0·5 m wide round the perimeter kept bare of vegetation. The feed troughs in experiment 1 were made of concrete and were 4 m long, while in experiment 2 galvanized iron troughs 3 m long were used.

EXPERIMENTAL ANIMALS. Forty steers 9 to 11 months of age of mean weight 194 $\pm$ 9 kg (S.D.), and 24 steers 18 to 21 months of age of mean weight 207 $\pm$ 15 kg were used for experiments 1 and 2 respectively. They were commercial Brahman x Shorthorn steers with approximately 50 % Brahman blood. All steers were given an anthelminthic treatment with 1-tetramisole hydrochloride and were visibly free from *Boophilus microplus* before experimental treatment began. All animals were dehorned.

FEEDING. The supplements were mixed thoroughly by hand and sprinkled over the roughage, which was coarse chaffed. At 10 a.m. daily, the steers were fed supplements and one-third of their daily roughage requirement. By 4.30 p.m. the steers had consumed all of the roughage plus supplement offered in the morning. Sufficient roughage was then added to bring the total amount of roughage offered to 25 % above the previous day's intake. On day 96 of experiment 1, the basal diet was changed from rice straw to native pasture hay as the supply of rice straw was exhausted. Rice straw was used throughout experiment 2.

Reject feed was removed from the troughs daily. Dry matter percentages of the feed and reject feed were determined by drying to constant weight in a forced draught oven at 100°C. Roughage, grain, biuret, mineral mix and reject feed were sampled daily and bulked samples for intervals of 3 weeks (experiment 1) and 2 weeks (experiment 2) were kept for analysis. The experimental feeding periods were 126 days and 63 days for experiments 1 and 2 respectively.

LIVEWEIGHT. At fortnightly intervals in experiment 1 and weekly intervals in experiment 2, unfasted liveweights were measured by weighing individual steers before the morning feed.

The end of the experimental feeding period was followed by a 7-day period on pasture to allow the realimentation. At the conclusion of this period, a final weighing was carried out. Initial and final liveweights were recorded off similar quality pasture.

DESIGN. *Experiment 1.* Five treatments were employed—

1. Roughage *ad libitum.* (Control)
2. Roughage *ad libitum* plus 142 g grain sorghum per head per day.
3. Roughage *ad libitum* plus 71 g biuret per head per day.
4. Roughage *ad libitum* plus 142 g grain sorghum plus 71 g biuret per head per day.
5. Roughage *ad libitum* plus 142 g grain sorghum plus 71 g biuret plus 36 g mineral mix per head per day.

The steers were divided into ten groups of four by stratified randomization on initial liveweight. The 10 groups were assigned to 10 pens at random and the treatments were assigned to the pens at random so that each of the five treatments was replicated.

Experiment 2. Three treatments were employed—

1. Roughage *ad libitum.* (Control)
2. Roughage *ad libitum* plus 71 g biuret plus 36 g mineral mix per head per day.
3. Roughage *ad libitum* plus 142 g sorghum plus 71 g biuret plus 36 g mineral mix per head per day.

The steers were divided into six groups of four by stratified randomization on initial liveweight. The six groups were assigned to six pens and treatments to pens at random so that each of the three treatments was replicated.

ANALYSES. Statistical analysis of liveweight changes for individual steers was done by analysis of variance. Pairwise differences between treatments were tested for significance by Student's t-test.

Chemical analyses of the roughage, grain, biuret and mineral mixture for nitrogen, phosphorus, sulphur and sodium were determined by the methods of the Association of Official Agricultural Chemists (1965).

TABLE 1

ANALYSIS OF FEEDS

N, P, S, Na Content of Hays and Grain Used in Experiments 1 and 2

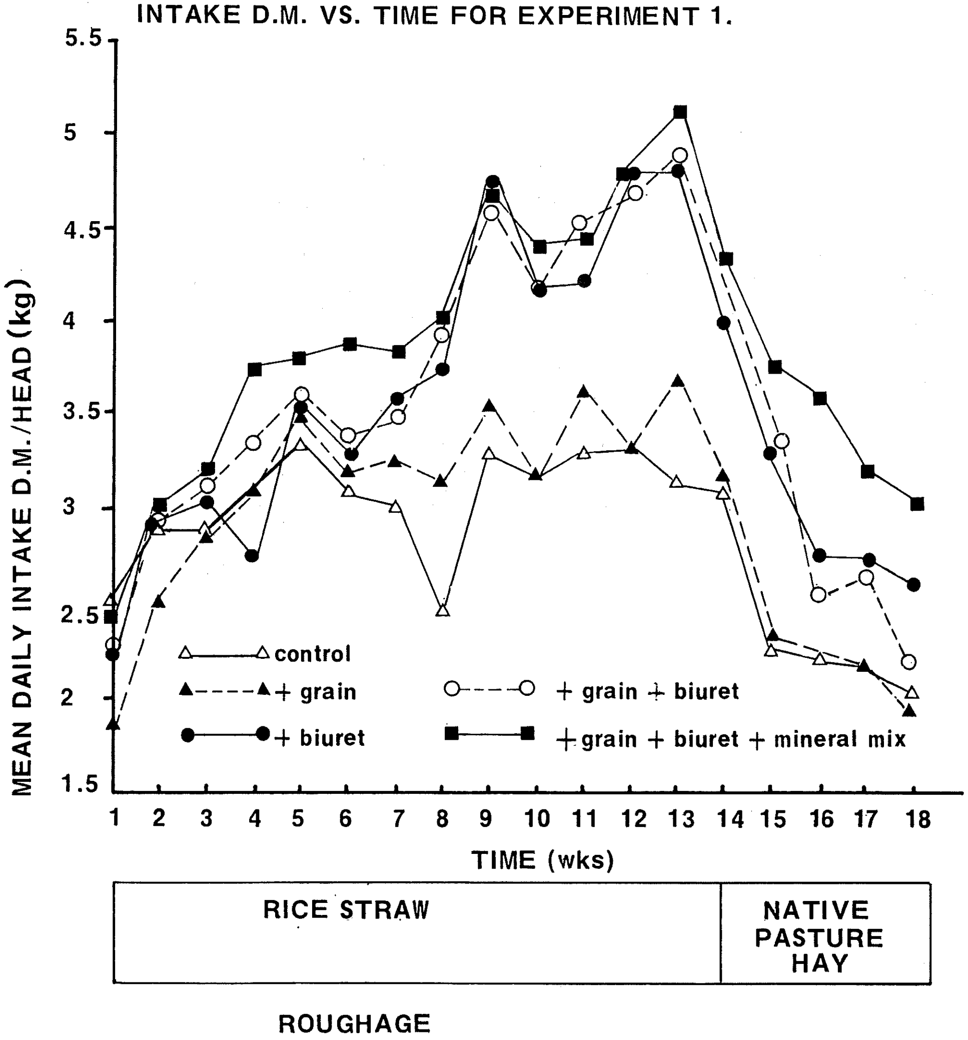
Ingredient	Analysis (% of D.M.)			
	N	P	S	Na
Experiment 1				
Rice straw	0·53	0·06	0·05	0·085
Native pasture	0·40	0·08	0·05	0·026
Grain sorghum	1·43	0·38	0·11	0·011
Experiment 2				
Rice straw	0·51	0·06	0·08	0·218
Grain sorghum	1·75	0·45	0·12	0·004

III. RESULTS

The chemical composition of the roughage and grain is given in table 1.

Intake of dry matter in experiment 1 increased steadily on all treatments from 0 to 12 weeks and then declined (figure 1). Intake increased steadily throughout experiment 2 (figure 2). In both experiments, all treatments receiving biuret had greater dry matter intakes than treatments without biuret. After 3 weeks in experiment 1 and 2 weeks in experiment 2, treatments receiving mineral mix had greater dry matter intakes than remaining treatments. By week 7 in experiment 1, groups receiving biuret but no mineral mix had intakes higher than control and hay plus grain groups, and had intakes approaching those of the group fed the mineral mix by week 8. Grain feeding in the presence or absence of biuret had little effect on dry matter intake in either study.

FIG. 1.
INTAKE D.M. VS. TIME FOR EXPERIMENT 1.



The pattern of liveweight change in experiment 1 (figure 3) was small weight gains from 0 to 10 weeks and weight losses from week 10 to the end of feeding. Only the biuret plus grain plus mineral mix treatment finished the experiment at a liveweight greater than its initial liveweight. Liveweight change was significantly ($P < 0 \cdot 05$) greater in the biuret treatments than in treatments without biuret after 10 weeks of feeding.

In experiment 2, the biuret plus mineral mix treatment had gained significantly ($P < 0 \cdot 05$) more liveweight than the control group by week 6. The biuret plus grain plus mineral mix treatment achieved significantly ($P < 0 \cdot 01$) greater liveweight than the control group by week 7.

In both experiments after realimentation on pasture, liveweight losses of all biuret treatments were significantly ($P < 0 \cdot 01$) less than treatments without biuret.

The intakes of water in experiment 2 were: control, 19·2 1 per head per day; biuret plus mineral mix, 22·4 1 per head per day; biuret plus grain plus mineral mix, 24·2 1 per head per day, measured over the period from 2 to 9 weeks. Water intake tended to remain at a constant level for the control group, but increased in the supplemented groups until week 4, from which time it remained relatively constant.

Fig. 2.
INTAKE D.M. VS. TIME FOR EXPERIMENT 2.

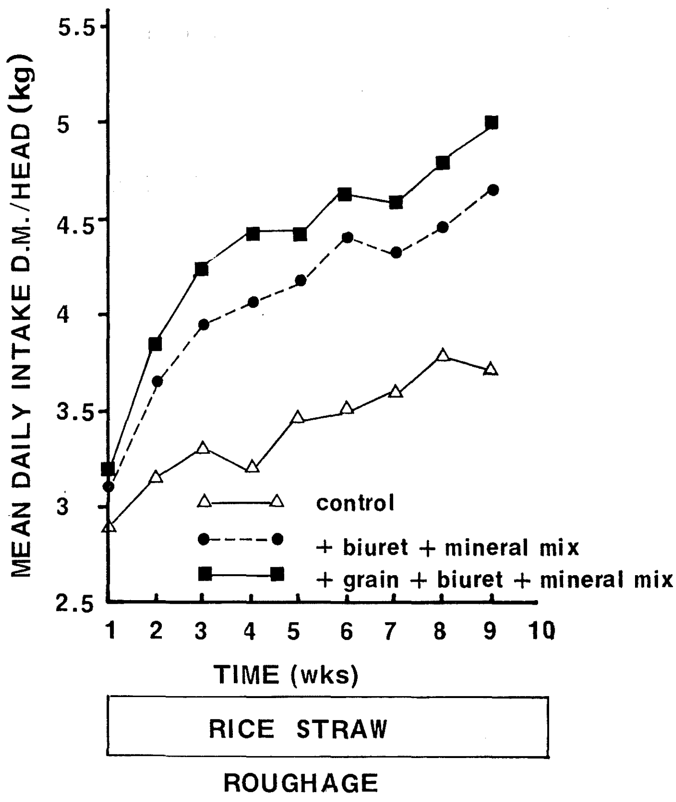


Fig. 3.
LIVEWEIGHT VS. TIME FOR EXPERIMENT 1.

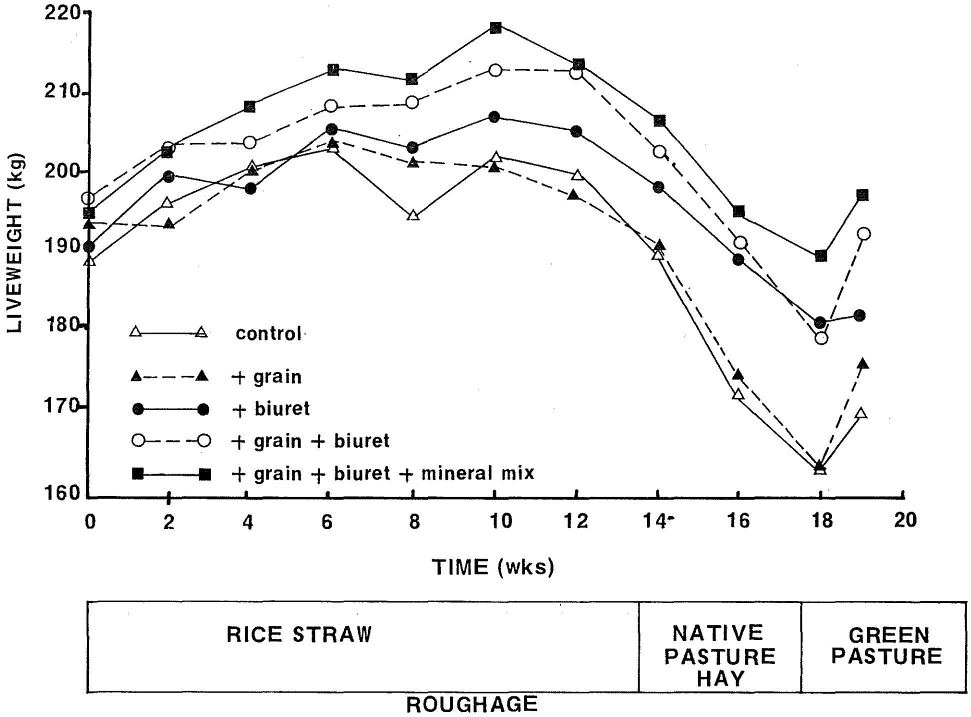
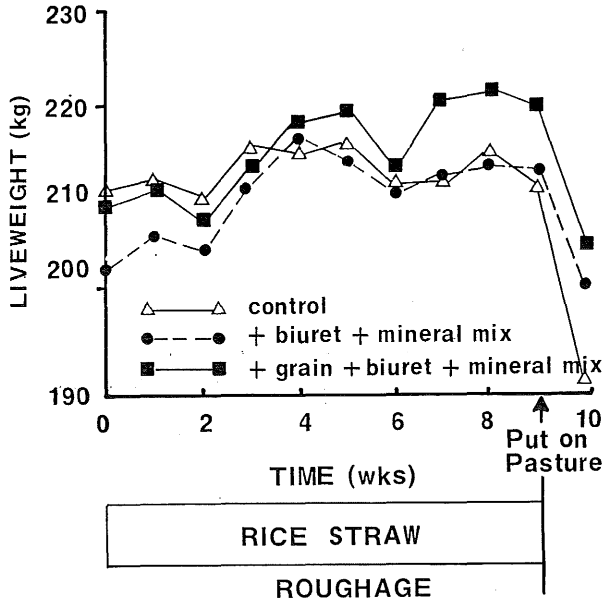


Fig. 4.
LIVEWEIGHT VS. TIME FOR EXPERIMENT 2.



IV. DISCUSSION

The apparent adaption period of 3 weeks for animals receiving a supplement of biuret plus mineral mixture with or without grain and of 7 weeks for biuret with or without grain, falls within the range of 15 to 70 days recorded by Schröder and Gilchrist (1969). These authors found that the shorter adaption periods were associated with lower quality feed. These results suggest that if intake is regarded as a reliable criterion of adaption then, with minerals, the multiplication of biuretolytic organisms could have been favoured. The practical significance of the greatly reduced adaption period where biuret and minerals are fed is a shorter period of supplementation, and a subsequent reduction in the cost of supplementation.

Biuret has been found to be as efficient as urea when judged by stimulation of hay consumption with sheep fed low quality roughage (Clark, Barrett and Kellerman 1963), and by liveweight response of grazing weaner cattle (L. Winks, personal communication). The general increase in intakes of the biuret supplemented groups is in agreement with the findings of Pieterse and Lesch (1964) and Clark, Barrett and Kellerman (1965). The continuing decline in intake in experiment 1 after the change in basal roughage could be expected as the new roughage, native pasture hay, was of lower quality (lower nitrogen content). The increase in intake of dry matter as a result of feeding the mineral mix in experiment 1 averaged 11% for the trial period. This increase could be a result of improved utilization of available nitrogen by the additional sulphur (Starks *et al* 1953). Supplementation with 3 g sulphur would have improved the N : S ratio to approximately the 15 : 1 suggested as necessary for the efficient utilization of the available nitrogen (Harris and Mitchell 1941).

The lack of response to the grain (113·6 g T.D.N., N.R.C. 1970) when compared with the 27·89% increase in D.M. intakes obtained by Ernst, Limpus and O'Rourke (1975) where a similar level of energy as molasses was fed suggests that some component other than energy was responsible. The response obtained by these authors may have been due to the abnormally high crude protein level (6·1%) in their molasses. Alternatively, the mineral component of molasses, which is higher in sodium (0·16%) (Morrison 1949) and sulphur (0·87%) (C.W.R. McCray personel communication) than the grain (table 1) could be responsible. Although the small quantity of grain had no beneficial effect, under field conditions it could serve as a palatable carrier for the supplement. Molasses could be used in place of the grain as it is cheaper, more palatable, and contains minerals.

The greater water consumption by the groups with the greater dry matter intakes is in agreement with the findings of Ledger, Rogerson and Freeman (1970). Rommel (1966) showed that inclusion of urea in the diet of cows had a marked diuretic effect, increasing urine output twofold to fivefold while Coombe and Christian (1969) found no effect of urea feeding on water intake in relation to feed intake.

The increased water consumption with one-protein nitrogen supplementation has serious practical implications especially on extensive properties where, in some cases, stock would normally come to water only every second day.

The increases in liveweights recorded during the trials are possibly the result of increased gut fill, as the roughages fed in both experiments were unable to meet the maintenance requirements of the animals in terms of energy, N, P, S and Na (N.R.C. 1970).

The significantly lower liveweight loss of animals receiving a biuret supplement is similar to the results of Mackenzie and Altona (1964) and Schoeman and Lishman (1965).

There is little work on the role of minerals in biuret supplementation. In roughages that are of insufficient nutritive value to maintain weight, there are likely to be deficiencies in some minerals. Work by Coombe, Christian and Holgate (1971), Siebert and Kennedy (1972) and Kennedy and Siebert (1972, 1973) indicate that under some circumstances sulphur is likely to be important. This was particularly so where urea was fed. In our experiments, a response in intake was obtained with mineral supplements but this was not reflected in liveweight performance. It is possible that this response was due to sulphur and its action was to increase rumen bacterial numbers (Moir and Harris 1962).

Supplementary minerals could easily be incorporated with non-protein nitrogen and salt or molasses where this form of supplementation is desirable.

Further work on individual minerals in biuret supplementation of low quality roughage diets is needed to clarify their role.

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