CONTROLLING THE INTAKE OF GRAIN SUPPLEMENTS BY CATTLE, USING UREA/SUPERPHOSPHATE

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SUMMARY

Urea/superphosphate (3:l) was progressively increased at 14 day intervals from 4 to 26.7% in a milled grain supplement provided ad lib. to cattle, together with ad lib. low quality hay, over 20 weeks. Concurrently, similar cattle were fed hay and a grain supplement containing 2.67% urea/superphosphate. Daily intake of the supplement containing 2.67% urea/superphosphate was around 1 kg/100 kg liveweight throughout, but decreased from about 1 to 0.3 kg/100 kg (47 to 15% of the total daily dry matter intake) as the urea/superphosphate content increased from 4 to 26.7%. Mean daily intakes of urea ranged from 30 to 67 g/100 kg liveweight, with wide variation among individuals and days, without clinical effects. Keywords: cattle, intake, urea, grain supplements.

INTRODUCTION

Since the report of Beames (1960), urea/molasses mixtures on free offer have been widely used to provide supplements of metabolizable energy (ME)and non-protein-nitrogen (NPN) in Queensland. The level of intake is controlled by the concentration of urea. Cattle grazing many southern Australian pastures also annually undergo prolonged periods during which the quality of paddock feed is low, at best supporting growth of less than 0.5 kg/day on dry pasture residues and at worst providing well below maintenance on dry grass residues and cereal stubbles. The cost of molasses in Southern Australia is very high relative to grains, but Morcombe et al. (1986) reported very profitable responses to low levels of a grain supplement fed out daily to cattle grazing a blue lupin stubble. It is probable that similar responses would be obtainable on other low-quality forages. Hironaka (1978) fed 200 kg calves an ad lib. supplement of grain containing 13% urea without ill-effect, and reported daily grain intake of only 0.43 kg/100 kg liveweight, while the intake of ad lib. low quality roughage offered concurrently was 2.25 kg/100 kg liveweight daily. Stubbles and grass residues are commonly low in nitrogen (N), phosphorus (P) and sulphur (S) as well as ME content making it very desirable to develop low cost techniques of providing self-limiting supplements. of these nutrients to cattle grazing many mature forages. Control of the intake of supplements fed ad lib. by modification of their composition is very desirable in order to reduce the labour cost of feeding them out. Cereal grain supplements are low in calcium (Ca). A mixture of 3:1 urea/superphosphate is a simple method of providing supplements of N, Ca, P and S in the ratio 14:2:1:1.2. The aim of this experiment was to investigate the effect of increasing levels of urea/superphosphate in a milled grain supplement fed ad lib. upon the intakes of supplement and a low quality roughage offered concurrently to cattle.

MATERIALS AND METHODS

Ten 20 months old Shorthorn steers were-allocated at random to either a control or a treated group. After introduction to milled wheat/oats (3:1) + urea over 14 days, the controls were provided continuously with 2.67% urea/superphosphate (3:1) in the grain supplement, while the treated cattle were supplemented with the same grain plus levels of urea/superphosphate which

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increased at 14-day intervals through the range 4, 5.33, 6.67, 8, 13.33, 16, 18.67, 21.33, 26.67%. Unmilled hay in feed bins identical to those containing the supplements was also provided ad lib. to all the cattle, which were kept in individual pens with no other feeds.

Intakes of hay and supplement were recorded for each animal daily and the cattle were weighed fortnightly. At slaughter, samples of tail bone were analysed for fluorine content in dry matter, Subsamples of the hay and grain were analysed for dry matter digestibility (DMD) using the technique of McLeod and Minson (1978) with a prior amylase digestion (Dunlop pers. comm), and crude protein' content (CP) (Isaac and Johnson 1976). Daily ME intake (MEI) was estimated from the DMD's and daily intakes using the equations in MAFF (1984).

The daily intakes were adjusted to a common (100 kg) liveweight basis and the effects of the treatment, the linear and quadratic trends through the experiment, and their interactions were first tested by analysis of variance. Subsequently, the significant terms ($p<0.05$) were included in regression analyses to estimate the relationship between the period on the experiment and the daily intakes. The effects upon growth rate were not included in the analyses because the periods spent on each level of urea/superphosphate were considered too short to provide reliable estimates.

RESULTS

The DMD s of the wheat, oats and hay were 87.8, 84.1 and 49.5% and their CP s were 13.1, 10.7 and 6.3%, respectively. Mean initial'liveweights on the control and increasing treatments were 370 and 355 kg, final liveweights were 460 and 447 kg, and bone fluorides were 3000 and 3500 ppm, respectively. All the animals remained in good health throughout the experiment.

Analysis of variance showed highly significant effects of the treatment upon the intakes of supplement, feed, urea and ME, and upon their changes during the experiment. Consequently, regression analyses of these variables were conducted separately for the control and treated cattle. However, hay intake was only significantly affected by treatment and did not change significantly. The supplement, hay, urea and ME intakes are shown in Fig.1-4.

The relationships between the daily dry matter intakes of supplement (SI), hay (HI), total feed (TI), urea (UI), and ME (MEI) per 100 kg liveweight and the corresponding 14-day Period (x) on the constant (con) and increasing (inc) treatments were (with standard errors in parentheses):-

kg SI (con) = 0.90(±0.095) + 0.125(±0.0400)x - 0.0141 (±0.00351)x^2; RSD*= 0.180
" (inc) = 1.07(±0.10) - 0.108(±0.0411)x + 0.0024 (±0.00364)x^2; RSD = 0.187 ,

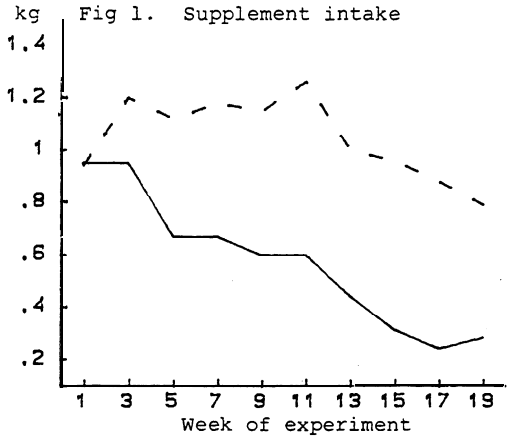
kg HI (con) = 0.85(±0.028)
" (inc) = 1.25(±0.028)

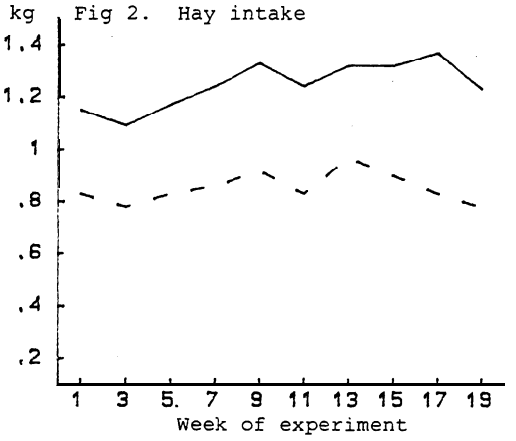
kg TI (con) = 1.63(±0.081) + 0.183(±0.0339)x - 0.0190 (±0.00300)x^2; RSD = 0.154
" (inc) = 2.09(±0.085) - 0.034(±0.0354)x - 0.0022 (±0.00313)x^2; RSD = 0.161

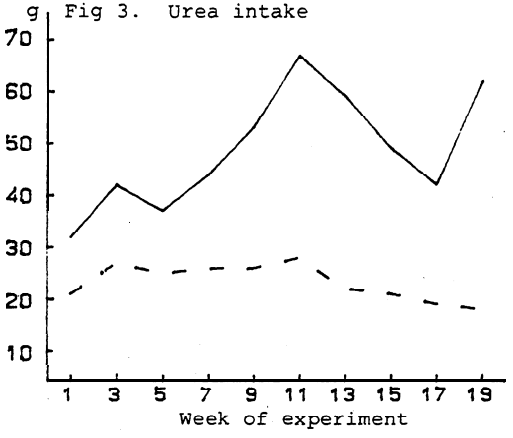
g UI (con) =20.01(±2.11) + 2.78(±0.881)x - 0.3125(±0.07810)x^2; RSD = 4.00
" (inc) =23.80(±7.51) + 8.35(±3.130)x - 0.5460(±0.27800)x^2; RSD = 14.30

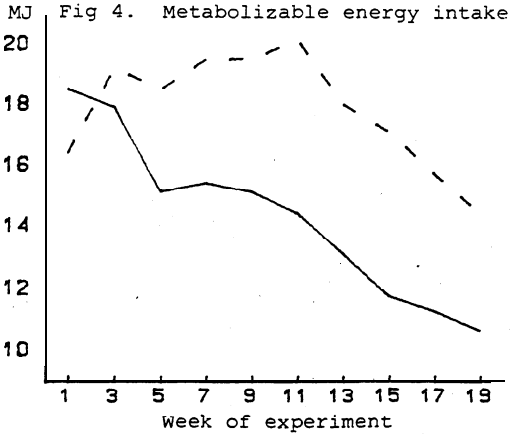
MJ MEI (con) =15.28(±0.809) + 1.84(±0.338)x - 0.1972(±0.02990)x^2; RSD = 1.54
" (inc) =19.19(±0.874) - 0.93(±0.365)x + 0.0064(±0.03230)x^2; RSD = 1.66

*RSD = Residual Standard Deviation









Figures 1-4. Daily dry matter intakes/100 kg liveweight of cattle fed grain supplements containing 2.67% urea/superphosphate for 20 weeks (- - - -) or 4, 5.33, 6.67, 8, 10.67, 13.33, 16, 18.67, 21.33 and 26.7% urea/superphosphate for consecutive 14-day periods (——).

The ratio of urea:ME intake fluctuated around 1.3 g per MJ on the constant (2.67%) urea/superphosphate treatment but ranged from 1.62 to 5.85 g per MJ at 4% and 26.7% urea/superphosphate in the supplement respectively. Urea intakes varied widely amongst individuals. on the increasing urea/superphosphate treatment; the highest day's value being 250 g/100 kg liveweight.

DISCUSSION

Increasing the urea/superphosphate content from 4 to 26.7% in a milled grain supplement-fed ad lib. to steers,also receiving ad lib. low quality hay, reduced intake of the supplement from about 1 kg down to 0.3 kg/100 kg liveweight daily. Intake of the hay did not increase significantly, so total intake also decreased with. increasing urea/superphosphate content of the supplement. This may have been a consequence of a declining rate of passage with the increasing proportion of low quality roughage in the diet and/or atotalintakelimiting

effect of excess urea in the diet. However, no clinical signs of ill-health were observed and we suggest that the supplement intake-limiting effect of urea/superphosphate is a consequence of generally low palatability. Beames (1960) reported consumption of about 2.4 kg supplement dry matter of 15% urea content, at which level ours only ate 1 kg, indicating that either molasses masks the low palatability of urea more than grain, or that the superphosphate added to our supplement also reduces the intake. Intake of urea was not as high as that reported by Beames (1960) whose animals peaked at about 400 g urea/head daily at 15% urea in the dry matter of a urea/molasses supplement. Our peak daily urea intake was less than 300 g per head average at 10% and declined to about 190 g/head at 15% urea content.

ME intake was reduced by the increasing urea/superphosphate treatment, but liveweight gain was unaffected, possibly because the lower nitrogen intake on the constant urea/superphosphate treatment resulted in less efficient utilization of the ME intake. ARC (1980) states that the rumen degradable nitrogen (RDN) requirement is 1.25 g per MJ ME intake. The RDN available as urea was around 0.6 g per MJ ME intake throughouton the constant urea/superphosphate treatment, but at all levels of urea/superphosphate above 8% in the supplement, the diet contained well above the requirement of RDN. In spite of very wide variation in urea intake amongst animals and days no clinical effects were apparent, indicating the development of a very high tolerance of excess urea intake by the cattle. After 5 months on the supplements, bone fluoride levels were still below 4000 ppm; higher levels are generally associated with toxicity.

We conclude that addition of a mixture of urea and superphosphate could be used to limit the consumption by cattle of milled grain supplements offered ad lib., whilst also supplying supplements of nitrogen, calcium, phosphorus and sulphur. In spite of high urea intakes, ammonia toxicity will not occur provided the animals acquire and maintain sufficient adaptation to urea by gradual introduction and consuming it continuously. Fluorosis is unlikely to occur within 5 months, using this technique.

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