MINERAL SUPPLEMENTATION OF BOS INDICUS CROSS CATTLE GRAZING NATIVE PASTURES IN TROPICAL QUEENSLAND

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SUMMARY

Initial investigation into commercial cattle production losses concluded a possible implication of a P deficiency. Results reported here of mineral supplementation of these animals indicated that while the available P levels were low, the condition may be complicated by poor protein nutrition.

INTRODUCTION

Production losses of cattle occur each year in the seasonally dry tropics of Queensland. In many areas clinical signs of bone demineralisation and depraved appetites are seen. Botulism is endemic. Supplementation with high P foodstuffs is common practice. However production losses continue.

The owner of one affected property requested help with identifying the causes of these production losses. Clinical signs reported by the owner as being exhibited by cattle dying on the property were indicative of botulism. However all animals mustered on the property are treated with multivalent botulism vaccine at least once a year. Autopsies of three lame cows indicated severe demineralisation of bone. Feeding two similarly affected cows with a high quality ration adequate in protein and minerals (in particular P) produced a marked improvement in their condition, although some lameness remained (F. Trueman, pers. comm.). It was practice to offer a mineral supplement during the dry season. The composition of the supplement was varied depending on availability of feedstuffs but always contained a high P component and sometimes urea.

In an attempt to determine the factors operating, a feeding trial was undertaken. The cattle were given a mineral supplement and observed through two dry seasons and one wet season. Production parameters plus blood and bone metabolite levels were monitored.

MATERIALS AND METHODS

Animals and location

The experimental area was a 4500 ha paddock on the commercial beef cattle grazing property, "Eurunga", Torrens Creek, located some 300 km west of the coast on latitude 21°S. The soil of the area was lowly fertile yellow earth receiving an average annual rainfall of 500 mm. The vegetation consisted of a semi-arid *Eucalyptus* woodland with dense thickets of *Acacia* and *Melaleuca* species over much of the area. The ground cover consisted of *Heteropogon*, *Aristida* and *Triodia* species plus annual grasses and forbes.

An experimental group of 164 breeding cows and 21 yearling steers was identified from a mixed herd of 304 Brahman X Shorthorn cattle. All animals had

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been vaccinated against botulism. Five bulls were introduced in January 1980 for six months.

Experimental

In October 1979, the experimental animals were selected, ear-tagged, weighed, sampled for blood and examined for pregnancy by rectal palpation. Where possible five animals from each reproductive class were biopsied for bone mineral analysis (Little 1972). The animals were mustered again in April 1980 and July 1980 for weighing, pregnancy diagnosis, blood sampling and bone biopsy (no bone samples were taken in July). Plucked pasture samples were obtained in April and July.

A mineral supplement containing 11.2% Ca, 11.1% Na, 6.2% P, 14.5% N and 1.5% S was obtained by mixing monoammonium phosphate, finely ground limestone, salt, urea and elemental S in the ratio 50:50:50:25:2.7. This mixture was offered from October 1979 until the first rain in January 1980 after which the urea was withdrawn. Supplementation with the new mixture containing 13.2% Ca, 13.0% Na, 7.3% P, 3.6% N and 0.7% S was continued until July 1980. Troughs containing approximately 40 kg of the mixture were located at seven sites and inspected weekly. At each refilling a small amount of molasses (2-3 kg) was placed upon the mix and thoroughly stirred through. Records were kept of the quantities of the mineral supplied. In July 1980 individual intakes of the supplement were measured using radioactive tracer techniques.

Analytical

Pasture samples were dried at 80°C for 24 h, ground and ashed at 550°C for 5 h. Following microkjeldahl digestion, P and N were determined by autoanalysis. Ca was determined by atomic absorption spectrometry (AAS) following HCl digestion of the ash. Fibre (NDF) was measured by the neutral detergent method. Fresh bone samples were scraped and cleaned to yield compact bone and the specific gravity determined. Fat-free bone obtained by ether extraction was ashed at 550°C for 8 h followed by 700°C for 3 h. Following HCl digestion of the ash, P and Ca were determined by autoanalysis and AAS respectively. Serum Ca concentrations were measured by AAS while P, urea-N and albumin were determined by autoanalysis.

RESULTS

Rainfall and pasture

The only rainfall recorded during the experiment was 63, 93, 22 and 14 mm in January, February, March and May respectively. The pasture sampled in April contained 754 g NDF, 5.4 g N, 2.8 g Ca and 0.6 g P per kg DM. While NDF concentration rose to 763 g/kg DM, the values for N, Ca and P all fell to 3.4 g, 1.5 g and 0.2 g/kg DM respectively by the July sampling.

Productivity

The dense nature of the vegetation made mustering difficult. Recovery of the animals tagged in October was 84% in April and 86% in July (75% were present at all musters). Results for productivity are presented on the basis of those animals present at each muster.

In October 1979, 58% of the breeding cows were pregnant; all of these had calved by April 1980 and 10% had subsequently become pregnant. By July 1980, of the cows non-pregnant in October 1979, 37% were pregnant.

Liveweight gain (g/head/day) by the steers during the first period was low (0.41 kg). During this period liveweight gain within the breeding herd was restricted to cows non-reproducing in April (0.24 kg) while liveweight loss was associated with late pregnancy and subsequent lactational demand (-0.25 kg). Cows that were not pregnant but lactated throughout the first period were able to maintain weight (0.04 kg). Very few cows (3%) were detected pregnant at the April muster. Animals which were pregnant in July had gained 0.12 kg during the second period while those lactating throughout this period lost 0.16 kg. Non-reproducing cows at this time had daily gains of 0.25 kg.

Supplement intake

The mean individual daily intake of the supplement was 117 g, 66 g and 141 g for the three months before, during and after the wet season respectively. Supplement intake was not significantly related to liveweight change, reproductive status or, with the exception of serum P, the blood and bone parameters measured. The significant regression ($P < 0.01$) of serum P (Y; mg/l) on supplement intake (X; g/head/day) was $Y = 56.3 + 1.0X$; $r = 0.40$.

Blood and bone chemistry

Although lactation significantly ($P < 0.01$) depressed serum albumin concentrations (34.5 v 39.3 g/l) there was no effect of season on this parameter. Serum urea-N levels were low even during the wet season (132.3 mg/l) but were greatly reduced ($P < 0.01$) in all animals in the dry seasons (38.2 mg/l).

An increase ($P < 0.01$) in serum Ca was observed throughout the trial for all animals (96.0 to 104.0 mg/l) while serum P was significantly ($P < 0.01$) lower in April (28.4 mg/l) than in October (46.3 mg/l) or July (64.7 mg/l). However this depression was not reflected in the fat-free bone P concentration which remained stable at 113 g/kg. The level of Ca in fat-free bone increased ($P < 0.05$) from 227.5 g/kg in October to 267.2 g/kg in April with a consequent increase in Ca:P ratio. There was a non-significant increase in ash density (ash/volume) from 914 mg/cm^3 in October to 925 mg/cm^3 in April with a similar fall in matrix density (FFOM/volume) from 512 mg/cm^3 in October to 501 mg/cm^3 in April.

DISCUSSION

There is considerable difficulty in conducting controlled experiments on commercial properties. Nevertheless much meaningful data can be obtained. The poor recoveries at each muster of the tagged cattle would indicate that the botulism vaccination program could not be completely effective. It is to be expected therefore that animals are seen with classical signs of the disease.

The mineral supplement provided was palatable to many animals. However a considerable number did notconsumesignificant amounts while a small percentage did not consume any supplement. It is not surprising therefore to encounter individuals with bone mineralisation problems in a herd despite the offer of mineral supplement.

The results of this investigation support the original diagnosis that P was deficient in the diets of cattle in the Torrens Creek area. While plucked pasture samples can be a poor indicator of the diet selected by cattle, the levels of P and N obtained were extremely low; levels of 0.2 and 0.6 g P/kg DM for October and April pastures respectively compare unfavourably with the recommended requirements (2 g/kg). The mean N content of the pasture samples, 5.4 g/kg at the April sampling, was much lower than the critical level (about

10 g/kg) below which intake is considered to be reduced. Further evidence suggesting N deficiency was the low serum urea-N levels particularly during the dry seasons.

In the face of N deficiency, P is utilised less efficiently, being evident in reduced P retention (Mudgal and Ray 1967) and bone demineralisation (Siebert et al. 1975). Although it is difficult to conclude reduced bone mineralisation from our results, evidence of the low P status of the animals can be found in the low bone P levels (113 g/kg). Cohen (1973) suggested that P content of less than 137 g/kg fat-free dry bone is indicative of P deficiency.

Studies with sheep (Sykes et al. 1973) suggested the main effect of inadequate N intake is a reduction in bone matrix (FFOM/volume ratio). Little (1972) showed with yearling cattle that a bone ash concentration as low as **845** mg/cm^3 can be obtained from P-repleted animals. However comparable data from older cattle on these two parameters are not available. The increase in the Ca:P ratio during the wet season from the normal 2:1 may be a reflection of bone turnover rate in the face of N and P deficiencies.

It is concluded that the nutritional problem was not simply a lack of P, but rather a combined mineral, protein and energy deficiency. The results obtained here support the view (Cohen 1975) that in the face of combined protein and P deficiency response to supplementation with P alone might not be expected.

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