A RESPONSE OF SHEEP TO COBALT SUPPLEMENTATION IN SOUTH-EASTERN QUEENSLAND

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Summary

Two separate experiments were conducted with sheep' grazing Pangola grass pastures. In the first experiment, eight groups of pregnant ewes (six ewes/group) were used. Each group received one of the following supplements, no supplement (control), phosphorus, sodium, iodine, cobalt, mineral mixture, sorghum grain and sorghum grain plus urea. Ewes supplemented with cobalt lost less weight during lactation and their lambs showed a higher and more sustained growth than did ewes or lambs from the other groups. In the second experiment, one group of weaned lambs (27) was drenched fortnightly with cobalt and their growth compared with a similar group of unsupplemented controls. All lambs given cobalt increased in live weight during which time 52% of the control lambs died. Evidence is presented which suggests that cobalt deficiency was the primary cause of the high mortality rate.

I. INTRODUCTION

Previous attempts to study the potential of tropical pastures for lamb production in south-eastern Queensland have demonstrated poor lamb growth and high levels of ewe and lamb mortality (Robertson 1972, Fleming 1974). Growth failure in these studies was not related to the type of pasture used (grass-legume mixtures), stocking rate or to the incidence endoparasitic or ectoparasitic diseases. The following experiments were designed to study the effects of various mineral and grain supplements on the growth of ewes and their lambs and to specifically investigate the response of weaned lambs to cobalt supplementation. Whilst cobalt deficiency in sheep has been demonstrated in many' areas of Southern Australia, there have been no previous reports of responses of sheep or cattle to cobalt supplementationin Queensland.

II. MATERIALS AND METHODS

(a) Location

The following experiments were conducted at the University of Queensland's research farm at Mt. Cotton in south-eastern Queensland. The climate of the region is humid, sub-tropical, with a marked summer dominance of rainfall. Average annual rainfall is 1400 mm. Soils on the farm are acidic, red-yellow podzols (Beckman 1967) and are representative of the soils found in some ¼ million ha. of coastal Queensland. These soils show major deficiencies of most elements needed for plant growth (Blunt and Humphreys 1970). .

(b) Pasture Management

Pangola grass [*Digitaria decumbens*, Stent.) pastures were established in 1970 with the following application of fertilizers (Kg/ha), superphosphate; 493, potassium chloride; 117, copper sulphate; 0.4,

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sodium molybdate; 0.2, zinc sulphate; 0.4. Since establishment maintenance dressings of superphosphate (250 Kg/ha) and potassium chloride (125 kg/ha) have been annually applied. Ammonium nitrate was applied as split dressings (60 Kg N/ha in May and August and 40 Kg N/ha in November and February). Pangola grass has proved to be well adapted to the area and negligible weed invasion has occurred.

(c) Experimental Design and Animal Management

Experiment 1. Sixty Border Leicester x Merino ewes (2-3 years), newly introduced to the property, were mated to Dorset Down rams in July, 1974, and after pregnancy confirmation, groups of six ewes were allocated to one of eight treatments. One half of each treatment group (three ewes) was randomly allocated to one of 16 paddocks (0.20 ha) where they remained for the duration of the experiment. The treatment supplements were as follows (per hd/d): control (no supplement), phosphorus (1.3 g $NaH_2PO_4.2H_2O$), sodium (0.5 g NaCl), iodine (1.3 mg KI), cobalt (0.4 mg $CoCl_2.6H_2O$), mineral mixture (1.3 g $NaH_2PO_4.2H_2O$, 1.3 mg KI, 0.4 mg $CoCl_2.6H_2O$, 2.5 g $MgCl_2.6H_2O$, 104 mg $ZnCl_2$, 61.5 mg $MnSO_4.H_2O$, 2.0 mg $CuSO_4.5H_2O$, 0.5 mg $NaMoO_4.2H_2O$), grain (480 g kibbled sorghum grain) and grain plus urea (480 g kibbled sorghum grain plus 12.4 g urea). Mineral supplements were administered fortnightly as a drench (180 ml) containing 14 times the daily supplement. Grain supplements were offered at weekly intervals from covered troughs.

All supplements were discontinued one week prior tolambing. Ewes and lambs were weighed (after an overnight fast) and drenched with tetramisole (Nilverm) at fortnightly intervals during the trial. Only ewes which had received supplements for the full experimental period and raised a lamb to weaning were considered in the analysis of results. Treatment replicates were combined for statistical analyses.

Experiment 2. Sixty Border Leicester x Merino ewes (3-4 years), which had been on the property for at least two years, were mated to Merino rams in March, 1974 and were maintained on Perennial Rye Grass pastures (N fertilized and irrigated) during pregnancy. Lambs from this flock were weaned in November onto Pangola grass pastures and maintained as a flock until January, 1975. Fifty-four lambswere then paired for weight and one of each pair allocated to one of the following treatments: control (no supplement) or cobalt (0.4 mg $CoCl_2.6H_2O$/hd/d). Groups of paired lambs (16,16 and 22 lambs) were held in three separate paddocks (66,66 and 72 lambs/ha respectively) for the ten week experimental period. Lambs were weighed after an overnight fast and drenched with their respective supplements and Nilverm every two weeks. Blood samples were taken from all surviving lambs at the end of the experiment. Four lambs from each group were slaughtered for post mortem inspection. Pasture samples were also collected during the experimental period.

(d) Analytical Methods

Cobalt levels in pasture were determined by the method of Simmonds (1973). Packed cell volume (PCV) and the concentration of haemoglobin (Hb) in blood were determined by standard clinical methods. Duplicate smears of fresh blood from each lamb were fixed in methanol and stained with Giesma stain and inspected for the presence of *Eperythrozoon ovis.*

III. RESULTS AND DISCUSSION

Mean values for the live weight changes of ewes and lambs in Experiment 1 are shown in Table 1. Ewes supplemented with either cobalt or cobalt containing mineral mixture lost significantly less weight ($P<0.05$) during lactation than did the unsupplemented controls. These

TABLE I

Mean liveweight changes of ewes and lambs given various mineral and grain supplements

Treatment	Ewe weight change (Kg/period) No. of Ewes	Pregnancy (128d)	Lactation (34d)	Lamb weight change (g/d) Birth Wt(Kg)	0-34d	35-58d
Control	5	12.8	-6.5	5.1	223	35
Phosphorus	4	13.2	-5.2	4.4	232	25
Iodine	4	14.5	-5.0	4.8	242	83
Sodium	5	15.7	-6.5	4.5	268	66
Cobalt	5	14.2	-3.5*	4.7	281*	198*
Mineral Mixture	4	12.1	-3.1*	4.1	264	137*
Grain	5	10.5	-7.4	4.8	220	58
Grain + urea	5	14.1	-8.1	4.1	202	46
±Standard Deviation		3.1	2.5	0.6	34	41

* Significantly different ($P<0.05$) from control group in same column

results suggest that unsupplemented ewes drew heavily on body tissues to meet the demands of lactation, whilst supplemented ewes were able to increase feed intake sufficiently to offset some of these demands. Lambs from supplemented ewes showed significantly higher and more sustained- growth during the post-natal period than did the unsupplemented controls. These differences may be due to either a higher quality and/or quantity of milk production by supplemented ewes thus permitting better growth of their lambs or may indicate that the lambs were receiving sufficient cobalt from the milk to initiate effective fermentation in the rumen and were therefore better able to wean themselves onto pasture when the milk supply from the ewe declined.

The live weight changes of lambs from experiment 2 are shown in Fig. 1. Prior to supplementation the growth rates of lambs in each group were similar. The live weight of lambs supplemented with cobalt increased throughout the experimental period. During the same time, 52% of the lambs in the control group died and the remaining lambs lost weight. Lambs from the control group appeared listless, usually had pale mucous membranes symptomatic of anaemia and showed respiratory distress when moved with the flock. Post mortem examination revealed no significant gross or histological abnormalities and death was attributed to malnutrition.

Cobalt supplementation did alleviate a normochromic, normocytic anaemia found in the control group. Mean values (±standard error) for PCV and Hb in the cobalt supplemented ($n=25$) and the control ($n=14$) groups were, respectively: PCV (%) 30.4 vs 26.0 (±1.2) and Hb (g/l), 106 vs 88 (±4). Both differences were significant ($P<0.05$). Anaemia associated with weaner ill-thrift has been related to Haemonchosis, deficiencies of Se, Cu and Co and to the presence of the blood parasite E. ovis (Pulsford, Rac and Irving 1966). In the present experiment, negligible worm burdens were found (<600 eggs/g faeces) and E. ovis was not detected in blood, indicating that the anaemia found was primarily due to Co deficiency. Mean levels of cobalt in the pastures grazed was 0.11±0.02 mg Co/Kg dry matter.

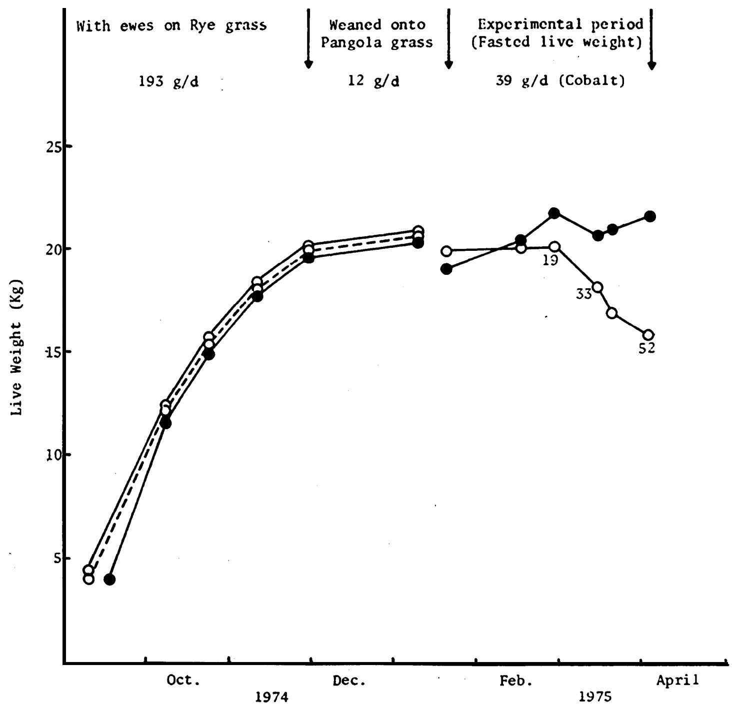

Fig. 1. The effect of cobalt supplementation on the post-weaning liveweight gain of lambs.
O—O Control lambs surviving trial (n=13), O--O Control lambs that died on trial (n=14), ●—● Lambs supplemented with cobalt.
Figures on graph represent the percentage mortality.

IV. CONCLUSIONS

The experiments described above clearly demonstrate that the availability of dietary cobalt was limiting the growth and survival of lambs on Pangola grass pastures. The levels of cobalt in pasture appeared adequate for mature and dry stock, but were inadequate to support more intensive forms of production such as lactation and lamb growth. Even when cobalt supplements were provided growth was relatively poor, suggesting that higher levels and/or more frequent supplementation may be required or that other properties of the pasture were limiting growth. Studies are continuing in this area to define more clearly the factors limiting lamb production from Pangola grass pastures.

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