# THE EFFECTS OF COBALT SUPPLEMENTATION OF PREGNANT HEIFERS ON LACTATION AND CALF GROWTH

M.F. QUIRK* and B.W. NORTON*

## SUMMARY

An experiment was conducted to measure the effects of cobalt supplementation of pregnant heifers grazing pangola grass pastures on lactation and calf growth. Seven pregnant Hereford heifers were used, with three of these receiving a cobalt bullet and grinder four months after insemination. Cobalt supplementation of heifers had no effect on subsequent milk production or composition. However, calves from supplemented heifers showed a higher growth rate and, at weaning, were 27 kg heavier than calves from unsupplemented heifers. The relationship between the cobalt and vitamin $B_{12}$ requirements of the calf and cow are discussed.

## INTRODUCTION

Cobalt responsive conditions have been described in cattle and sheep grazing improved tropical pastures in Queensland. Winter *et al.* (1977) and Nicol and Smith (1981) report significant responses in growing cattle to cobalt supplementation in the Cape York Peninsula (0.49 kg/day) and Bundaberg (0.16 kg/day) areas respectively. At Mt. Cotton, south-east Queensland, Norton and Hales (1976) found a response to cobalt supplementation in lactating and growing sheep. Cobalt supplementation of ewes increased lamb growth rates by increasing milk production of the ewes (Davis 1980), while provision of cobalt to lambs at weaning improved growth and survival. However, there was no growth response to cobalt in growing cattle (200-250 kg) grazing the same area (Norton, unpublished data). While it is generally reoognised that the intake of digestible energy limits production of lactating cattle grazing tropical pastures, little attention has been given to the cobalt nutrition of these cattle. Alexander *et al.* (1967) reported a response in cows and calves to copper but not to cobalt supplementation in central coastal Queensland, although a significant response in growth of weaner cattle to cobalt was recorded in one year. The following experiment was designed to study the effects of cobalt supplementation of pregnant heifers on lactation and calf growth.

## MATERIALS AND METHODS

### Location and pasture management

The following experiment was 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.

Pangola grass (*Digitaria decumbens*, Stent) pastures were established in 1970 and maintenance dressings of superphosphate (250 kg/ha) and potassium chloride (125 kg/ha) have been applied annually. During the trial, urea was applied as split dressings (four applications of 25 kg N/ha in each year). Pangola grass has proved to be well adapted to the area and negligible weed invasion has occurred.

### Experimental design and animal management

Seven Poll Hereford heifers (2 yrs mean liveweight 316 kg) newly introduced to the property, were artificially inseminated with semen from a Poll Hereford

*Department of Agriculture, University of Queensland, St. Lucia. 4067

bull in May 1980. After confirmation of pregnancy in early October, three heifers were given a cobalt bullet and grinder (I.C.I.). The heifers were grazed as one group on an area of 3.6 ha and were drenched with tetramisole (*Nilverm*) every four weeks. Calving occurred in March, 1981 with three bull calves and four heifer calves. The calves were drenched (*Nilverm*) every four weeks and weaned at the end of the trial, when their average age was six months.

Heifers were weighed, from pasture, at monthly intervals until calving. Calves were weighed at birth and heifers and calves weighed at monthly intervals during lactation.

Milk production of each heifer was measured and sampled at monthly intervals by machine-milking using an injection of 20I.U. of oxytocin (Pitocin - Parke, Davis and Company) and a four hour separation period (Le Du *et al.* 1978). Blood samples were taken from all animals at monthly intervals after calving, and pasture was sampled at two-monthly intervals during the trial.

## Analytical and statistical methods

Cobalt levels in unground pasture material were determined by the method of Nicol and Smith (1981). Packedcellvolume (PCV) of blood samples was determined by using a micro-haematocrit centrifuge, and the concentration of haemoglobin in blood was determined by the cyanmethemoglobin method. Milk samples were analysed for total solids by drying to constant weight at 95°C. Milk nitrogen was determined by the Kjeldahl method, and milk protein calculated as (N x 6.38). Milk fat content was determined by the Te-Sa method (A.O.A.C. 1970). The differences between treatment means were tested for statistical significance by the Student's t-test (Steel and Torrie 1960).

## RESULTS

Mean values for milk production and composition at each milkingarepresented in Table 1. There were no significant ($P < 0.05$) differences in either milk production or in the concentrations of total solids, protein and fat in the milk between the supplemented and control heifers.

Mean values for the liveweight changes of calves (g/day and g/l of milk yield) during each lactation period are shown in Table 2. Cobalt supplementation of heifers had no effect on birth weight of calves (33 vs 32 kg). However, the liveweight gain of calves from supplemented heifers was consistently higher than that of calves from control heifers, although this difference was only statistically different during the third month of lactation. By 10 weeks of age, calves from supplemented heifers were significantly ($P < 0.05$) heavier than calves from control heifers (75 vs 63 kg) and by weaning, at six months of age, the liveweight advantage for calves from cobalt supplemented heifers had increased to 27 kg. Calves from unsupplemented heifers had a consistently lower rate of weight gain per litre of available milk throughout the experimental period, with a significant difference occurring in the third month of lactation.

Mean liveweight change of heifers over the entire experimental period was a gain of 5 kg for supplemented heifers and a loss of 2 kg for control heifers. This difference was not significant. Whilst cobalt supplemented heifers had significantly ($P < 0.05$) higher PCV (39 vs 33%) and Hb (12.6 vs 10.9 gm %) levels one month after calving, these differences were not sustained nor reflected in changes in PCV and Hb content of blood for calves. The mean cobalt content of plucked green leaf from the pangola grass pastures was 0. 07 ppm (range 0.04 - 0.12).

TABLE 1 Mean values for milk production (l/d) and the total solids, protein and fat content (g/kg) of milk from heifers with and without cobalt supplementation

| | Months after calving | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 6 |
| Milk Yield (l/d) | | | | |
| Cobalt | 6.73 | 6.23 | 3.97 | 3.52 |
| Control | 5.76 | 5.16 | 3.76 | 3.10 |
| S.E. of difference | 0.79 | 0.98 | 0.66 | 0.38 |
| Total Solids (g/kg) | | | | |
| Cobalt | 121 | 120 | 111 | 125 |
| Control | 116 | 120 | 108 | 127 |
| S.E. of difference | 8 | 5 | 5 | 7 |
| Protein (g/kg) | | | | |
| Cobalt | 30.3 | 28.8 | 28.5 | 30.5 |
| Control | 28.6 | 28.2 | 27.1 | 32.6 |
| S.E. of difference | 2.1 | 1.6 | 1.1 | 2.1 |
| Fat (g/kg) | | | | |
| Cobalt | 40 | 36 | 36 | 42 |
| Control | 36 | 38 | 36 | 40 |
| S.E. of difference | 7 | 4 | 3 | 6 |

TABLE 2 Mean liveweight changes of calves (g/d and g/l milk yield) reared by heifers with and without cobalt supplementation

| | Period of lactation (months) | | | |
|---|---|---|---|---|
| | 0-1 | 1-2 | 2-3 | 3-6 |
| Liveweight Change (g/d) | | | | |
| Cobalt | 619 | 607 | 619* | 587 |
| Control | 482 | 447 | 291 | 490 |
| S.E. of difference | 69 | 65 | 95 | 124 |
| Liveweight Change (g/l milk yield) | | | | |
| Cobalt | 110 | 95 | 113* | 153 |
| Control | 86 | 86 | 71 | 139 |
| S.E. of difference | 28 | 6 | 13 | 35 |

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

## DISCUSSION

In this study, cobalt supplementation of heifers during pregnancy did not significantly affect birth weight of calves but the subsequent liveweight gain of calves from the supplemented heifers was significantly better than that of calves from unsupplemented heifers. These differences in growth rate were not clearly related to either milk yield or composition. Responses in progeny growth to cobalt supplementation of the dam have been recorded in southern Australia in sheep (O'Halloran and Skerman, 1961) and cattle (Skerman and O'Halloran 1962). These responses were associated with increased liver vitamin $B_{12}$ concentrations in the young at birth and with an increased vitamin $B_{12}$ content of milk. However, these workers did not measure milk yield and the contribution of low milk yields in unsupplemented dams to the growth response in these experiments is unknown. Davis (1980) found that cobalt supplementation of ewes grazing pangola grass increased lamb growth by increasing milk production.

Although there were no apparent differences in milk composition, in our experiment, between the supplemented and control heifers, calves from the supplemented heifers apparently used available milk with a higher efficiency for growth than did calves from the unsupplemented heifers. Thus, it is evident that the tissue requirement for vitamin $B_{12}$ in calves from unsupplemented heifers was not satisfied. Until the calf develops a functional rumen, which can then contribute vitamin $B_{12}$ from dietary cobalt, it is dependent on liver reserves of the vitamin accumulated during foetal development and on the supply of vitamin $B_{12}$ in milk. The route through which cobalt supplementation of heifers satisfied the tissue vitamin $B_{12}$ requirement of their calves in this experiment remains to be determined.

The response in calf growth to cobalt supplementation of the heifer during pregnancy recorded in this experiment is an example of a marginal cobalt deficiency. The extent to which such deficiencies are involved in the poor growth and low weaning weights of calves grazing tropical pastures is unknown, and is therefore a problem requiring further research.

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