An effect of copper supplementation on growth of beef cattle in Northland

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ABSTRACT

In an 11 month copper supplementation trial in Northland, weaner steers (initial live weight 210 kg) showed decreased liveweight gain when supplemented with copper, from November to March. Pasture copper concentrations were adequate throughout the trial. Serum copper concentrations tended to be low, especially in spring.

Keywords Copper; cattle; liveweight gain.

INTRODUCTION

Of 23 copper dose-response trials reviewed by Phillippo (1983), 8 were shown to have resulted in increases in liveweight gain with copper supplementation, in 9 there was no effect, and in 6 the result was equivocal. This paper describes a trial in which copper supplementation reduced liveweight gain in beef cattle.

MATERIALS AND METHODS

The trial was conducted on Punakitere Special Investigation area (Shannon and During, 1980). Ninety six weaner Angus steers were allocated at random to 4 groups of 11 and 4 groups of 13. Each group was allocated to 1 of 8, 1.6 ha farmlets, each consisting of 4, 0.4 ha paddocks. The animals were rotationally grazed around these farmlets. In late November, sufficient animals were removed from each group to reduce the stocking rate to 5 steers/ha (8 per group).

Initially half the animals in each group were treated with copper (120 mg as copper glycinate) on 4 occasions (April, August, October and February). The numbers of animals in the copper treatment groups, were kept balanced while destocking. Animals were weighed, treated with anthelmintic and blood sampled for serum copper estimations at the end of each rotation.

RESULTS AND DISCUSSION

Copper concentrations were lower, and molybdenum concentrations higher, in pasture harvested in September than at other times of year (Table 1), while pasture sulphur concentrations were lowest in April. Because of these changes, percentage and concentration of absorbable copper calculated according to Suttle (1983) were lower in September than at other times. The concentrations of copper in the pastures met the recommended dietary allowances of 8-15 mg/kg live weight (Agricultural Research Council, 1980), and were well above the minimum requirements given by Suttle (1983). The copper requirements of these animals were therefore met throughout the trial.

TABLE 1 Concentrations of copper, molybdenum, sulphur and absorbable copper (Suttle, 1983) in pasture sampled on 4 occasions.

Month	Cu (mg/kg)	Mo (mg/kg)	S (g/kg)	Absorbable copper (%)	Absorbable copper (mg/kg)
April	10.5	0.31	3.0	6.0	0.64
June	10.1	0.40	3.9	3.9	0.40
September	9.5	0.52	3.9	3.4	0.33
January	10.4	0.29	3.7	5.3	0.54
SEM	0.3	0.04	0.1	0.3	0.03

Serum copper concentrations in unsupplemented animals were below those indicative of copper deficiency (<7.8 μ mol/l; Grace, 1983) between August and November, (Fig. 1) following periods when absorbable copper concentrations in pasture were at their lowest. There was a rapid rise in serum copper concentrations in the month after the February injection in both copper supplemented animals and controls. Absorbable copper concentrations in pasture were high in January, preceding this rise.

Supplementation resulted in a highly significant increase in serum copper concentration on all occasions, but the copper concentration in sera of supplemented animals was never as high as that found in animals with adequate copper diets (12.6-18.9 μ mol/l; Grace, 1983), except in March.

The animals started the trial in April at 210 kg live weight and gained 154 kg by November (Table 2) after which some animals were removed to reduce the

TABLE 2 Effect of copper supplementation on cattle live weight and liveweight gain over 11 months. Steers stocked at 6.8 and 8/ha April to November and 5/ha November to March.

Treatment	Live weight April (kg)	Live weight November (kg)	Liveweight gain Apr-Nov (kg)	Live weight November (kg)	Live weight March (kg)	Liveweight gain Nov-Mar (kg)
Copper supplemented	209	362	153	362	394	31.2
Control	211	366	156	366	406	40.4
No. per group	46	46	46	32	32	32
SED	1.7	3.3	3.3	3.2	3.7	3.2
Significance	NS	NS	NS	NS	**	**

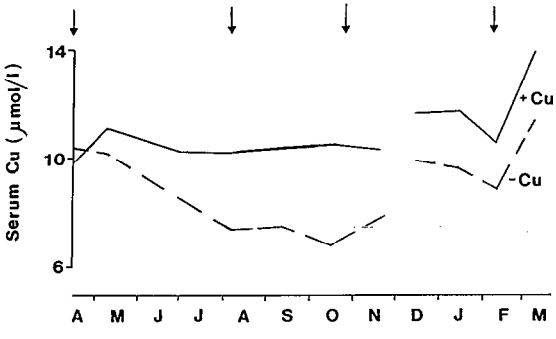

FIG. 1 Serum copper concentrations in copper supplemented (+Cu) and control (−Cu) animals. Copper injected on occasions marked. Differences between treatment groups were highly significant ($P<0.001$) or significant ($P<0.05$) (May) on all occasions except in April.

stocking rate. Over that period copper supplementation had no effect on liveweight gain, in spite of the low serum copper concentrations in the control groups (Fig. 1). Mean weights of the 2 treatments were not altered by the destocking policy. Between November and March, copper supplemented animals gained 9.2 kg (nearly 25%) less than the controls. This difference was highly significant and resulted in a highly significant difference in final live weight between the 2 treatments. This decline in growth rate of supplemented animals was evident by December and the difference between treatments increased with time. For the 11 month trial period, the difference in liveweight gain was 12 kg for the animals retained throughout the trial.

Copper is well known to be highly toxic to sheep (Grace, 1983) and toxicity has also been noted in young cattle (Howell, 1983). A mild degree of toxicity may have occurred in this case. In addition, the form of copper given in this trial has been known to cause a reaction at the injection site, although no such reactions were noted in these cattle.

In this trial, animals grazing pasture containing adequate concentrations of absorbable copper still exhibited serum copper concentrations well below the accepted normal range, and over a short period, within the range indicative of copper deficiency. In spite of these apparently low serum copper concentrations, no increase in liveweight gain with copper supplementation was recorded over that period.

In the last 5 months of the trial, when growth rates of unsupplemented animals were low, and their serum copper concentrations still below that considered normal, copper supplementation reduced liveweight gain by nearly 25%.

This indicates that the common practice of administering copper as an insurance against copper deficiency is fraught with uncertainty.

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