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The effect of stocking rate on response to cobalt supplementation in sheep

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ABSTRACT

Ewe hoggets were run at 2 stocking rates and at 4 levels of injection with hydroxycobalamin (0, 30, 100 and 3,000 μg monthly). Responses in live-weight gain were related to grazing intensity. Without supplementation, mean live-weight gain/head from July to November was 4.5 and -1.5 kg for high and low stocked groups respectively. With 3,000 μg hydroxycobalamin the equivalent gains were 8.0 and 17.9 kg. The interaction was highly significant ($P<0.001$). In an earlier period (March to July) there were much smaller responses to injection and no discernible interaction. Serum B_{12} was increased by injection with hydroxycobalamin but stocking rates had no significant effects on serum B_{12}. The implications of these results for cobalt response trials and for farm management are discussed.

Keywords Hoggets; cobalt; B_{12} supplementation; stocking rate; live-weight gain; serum B_{12}

INTRODUCTION

Published evidence of cobalt deficiency in Northland is circumstantial (Andrews, 1972; Sutherland *et al.*, 1979) and responses to cobalt supplementation in unpublished trials have been variable. The fact that there are few responses to cobalt may be because deficiencies are rare in Northland or because they are obscured by other factors. One such factor could be length of pasture. Andrews *et al.* (1958) and I. P. M. McQueen (unpubl.) found an association between length of pasture and cobalt status in the animal. The proffered explanation was that the higher soil contamination of short pastures contributed adequate cobalt to intake (Andrews *et al.*, 1958).

This paper reports an experiment examining the interaction between grazing intensity and rate of supplementation with vitamin B_{12} on live-weight gain, wool production and blood serum B_{12}.

METHODS

The experimental design was a split plot of 4 rates of vitamin B_{12} supplementation (0, 30, 100 and 3,000 μg hydroxycobalamin per head) injected at 4-weekly intervals, over each main plot of either low (9.3 hoggets/ha) or high (18.0 hoggets/ha) stocking rates. There were 3 replicates.

The site was on a property on which responses in live-weight had been obtained to B_{12} supplementation in 1981 (I. P. M. McQueen unpubl.). Three paddocks were selected that had low pasture cobalt content (0.03 to 0.04 mg/kg DM). Each paddock was subdivided in the proportion 2:1 to provide 2 stocking rate areas with the 3 paddocks as replicates.

In December 1981 freshly weaned Perendale ewe lambs were formed into 8 groups of 25. The groups were balanced for initial live-weight and allocated at random to treatments. From December 1981 to March 1982 the animal replicates were combined in 1 flock and rotationally grazed round the 3 replicate areas. In March 1982, each treatment was split proportionately into replicate groups and set-stocked until November. The sheep were weighed, injected with hydroxycobalamin, and drenched with anthelmintic, every 4 weeks. During each of the first 3 months blood samples were taken from 15 animals in each vitamin B_{12} treatment. After March the sampling interval was increased to 8 weeks and the sampled animals to 12 from each of the 8 treatments. The serum was assayed for vitamin B_{12} concentrations at the Whangarei Animal Health Laboratory using Becton-Dickenson radioassay kits. Sheep were shorn in March and August, with individual fleece weights being recorded at the second shearing.

RESULTS

During the first period (December to March) when the lambs were rotationally grazed, significant differences ($P<0.05$) developed in the concentrations of serum B_{12} between rates of supplementation of hydroxycobalamin (Fig. 1). No differences in live-weight gain were recorded.

After set-stocked grazing commenced in March it became increasingly apparent that 1 replicate was behaving differently to the other 2. On this replicate, mean serum B_{12} levels in untreated sheep rose to over 400 pmol/ℓ as compared with less than 100 on the others; there were no effects of injection of B_{12} on live-weight. Analysis of herbage showed a cobalt content

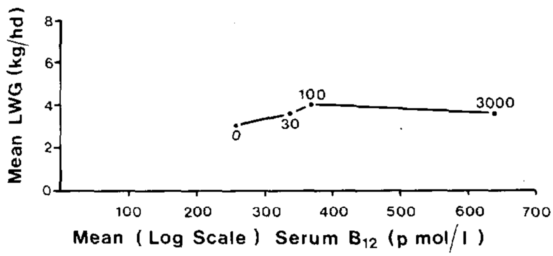

FIG. 1 Effect of rate of B_{12} supplementation on live-weight gain and serum B_{12}—December to March.

of 0.1 mg/kg DM. Consequently the treatment effects presented in Figs. 2 and 3 exclude this non-conforming replicate.

From March to June both live-weight gains and serum B_{12} followed similar patterns within stocking rates (Fig. 2). There were differences between B_{12} treatments in both parameters within stocking rates ($P<0.05$) but only in live-weight gain between stocking rates ($P<0.05$).

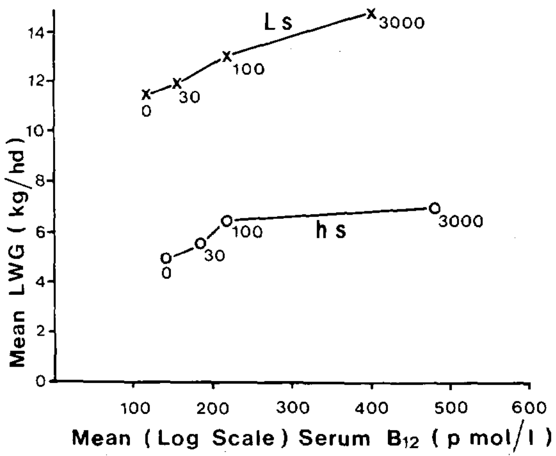

FIG. 2 Effect of rate of B_{12} supplementation on live-weight gain and serum B_{12} of lambs at high (o) and low (x) stocking rates—March to June.

From June to November (Fig. 3). the patterns of response changed, especially among low stocked sheep. Untreated, low stocked, animals lost weight but there was a large response in live-weight gain to increasing rates of B_{12} injection. In the high stocked groups the responses were much less and not significant. The interaction between stocking rate and B_{12} injection was highly significant ($P<0.001$).

Over this period serum B_{12} was increased only by the highest rate of hydroxycobalamin injection. Although the high stocked groups tended to have greater serum B_{12} concentrations than the low stocked, there was no real test of the differences, nor of the interaction between B_{12} and stocking rate treatments.

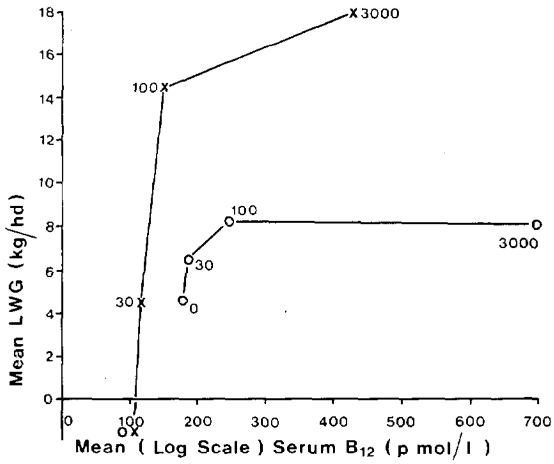

FIG. 3 Effect of rate of B_{12} supplementation on live-weight gain and serum B_{12} of yearling ewes at high (o) and low (x) stocking rates—June to November.

The weight of greasy wool grown between March and August also showed an interaction between stocking rate and B_{12} treatment ($P<0.05$). At the high stocking rate there were no significant differences between B_{12} treatments (mean 1.44 kg/hd). At the lower stocking rate there was an increase ($P<0.05$) of about 0.5 kg in weight of wool attributable to the highest B_{12} treatment.

DISCUSSION

It appears that grazing intensity can influence live-weight responses to injections with vitamin B_{12}. In this experiment the effects were noted between June and November but not between March and June. Andrews *et al.* (1958) obtained depressions in live-weight gain under lenient grazing of lambs in early autumn (February to April) but not from November to January. Although these effects were associated with length of pasture, the different response periods in each trial suggest that other factors are primarily responsible. Soil contamination of trampled, subsequently consumed, pasture may be implicated. Even in cobalt deficient areas there is ample cobalt in soil for animal needs but it is not necessarily available (Mitchell *et al.*, 1957).

As in the present trial, Andrews *et al.* (op. cit.) noted differences in deficiency status between apparently similar paddocks on the same soil types. Attempts to distinguish such areas in the present work through analysis of pasture cobalt content were unreliable as indicated by the variation from 0.03 mg/kg in 1981 to 0.1 mg/kg in 1982 for the anomalous replicate. Such localised areas of deficiency suggest that categorising soil types, or even properties, as either deficient or not deficient cannot be justified. Where there is no widespread deficiency, as in Northland, there may still be small pockets of land where the deficiency could seriously limit performance.

These results suggest that field response trials need to be closely related to specific areas of land and specified grazing intensities. Responses to cobalt supplementation are less likely under hard, than lax, grazing and even then can vary from period to period (Figs. 2,3).

On farms where cobalt deficiency occurs on some, but unidentified, paddocks, it may not become apparent until sheep are confined to those areas. Even then the deficiency may be concealed by hard grazing. Thus rotational grazing and heavy stocking may provide a method to avoid the effects of cobalt deficiency in situations where it is not general.

A further possibility, raised by the rotational grazing phase of this trial, is that of creating 'safe' areas through topdressing with cobalt sulphate and incorporating those areas in the grazing rotation. Although cobalt topdressing has been shown to be effective in raising serum B_{12} levels it has become expensive on a farm scale. The potential economies make the use of safe areas a suitable technique for further investigation.

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REFERENCES

Andrews E. D. 1972. Trace elements in pasture and their effects on animal health. *Proceedings of the New Zealand Grasslands Association* **34**: 71-76.

Andrews E. D.; Stephenson B. J.; Anderson J. P.; Faithful W. C. 1958. The effect of length of pastures on cobalt-deficiency disease in lambs. *New Zealand journal of agricultural research* **1**: 125-139.

Mitchell R. L.; Reith J. W. S.; Johnstone Isabel M. 1957. Trace-element uptake in relation to soil content. *Journal of science, food and agriculture* **8**: s51-s59.

Sutherland R. J.; Cordes D. O.; Carthew G. C. 1979. Ovine white liver disease—an hepatic dysfunction associated with vitamin B_{12} deficiency. *New Zealand veterinary journal* **27**: 227-232.