No. 20 January 1982

COBALT AND COPPER IN CATTLE AND PASTURES IN THE TOP END OF THE NORTHERN TERRITORY - SOME OBSERVATIONS

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SUMMARY

The available evidence relating to copper and cobalt in pastures and cattle in the Top End of the Northern Territory is reviewed and discussed.

A small response to vitamin B12 injections with cattle on dry Pangola grass was noted, but no response was shown to cobalt bullets.

In general, the copper and cobalt status appears adequate though further study is warranted.

INTRODUCTION

Deficiencies of cobalt/vitamin B12 and copper result in general ill-thrift in cattle. Thus it is natural that there has been speculation about deficiencies of these elements in Top End cattle which often appear unthrifty.

Recent reports from north Australia include responses to cobalt/copper therapy in the presence of molasses based supplement in Queensland wet tropics (Copeman et al. 1977), response to cobalt therapy at Cape York (Winter et al. 1977) and in S.E. Queensland (Nicol and Smith 1981; Norton and Hales 1976 with sheep), and a small response to copper but not to cobalt in the West Kimberleys (Holm and Payne 1980). Gartner et al. (1980) recently reviewed the situation of mineral deficiencies of grazing stock on tropical pastures in Australia.

This Technote reports a cobalt/vitamin B12 trial near Darwin and summarises other experience with cobalt and copper in cattle and pastures in the Top End of the Northern Territory.

Agdex 420/65

ISSN 0158-2755

COBALT/VITAMIN B12 SUPPLEMENTATION TRIALS 1976-79

Two trials were done by A.J. Ross at Berrimah Research Farm near Darwin as follows.

(a) Vitamin B12, 1976-77

A group of 26 steers weighing about 200 kg were selected from a mob at Katherine and were described as "looking rough".

On 20.10.76 they were weighed, treated for worms and placed on dry Pangola grass. From 1.11.76 they were supplemented with 0.5 kg/hd/day meat and bone meal which was discontinued when the pasture greened up in late November. Half the steers were injected weekly with 0.5 ml of 1 000 µg/ml vitamin B12 per animal for 7 weeks from 20.10.76. Stock were weighed weekly.

Results of liveweight changes are presented below.

Date	Mean liveweight gains (kg)			
	+B12	-B12	Difference	Significance
20.10.76-15.11.76	22.9	16.2	6.7	P<.05
20.10.76-17.1.77	44.3	42.9	1.4	N.S.
*15.11.76-13.12.76	-8.4	-5.5	2.9	N.S.
15.11.76-17.1.77	21.5	26.8	5.3	N.S.

* The pasture greened up in the week following 15.11.76.

Vitamin B12 injections caused a significant liveweight gain from 20.10.76-15.11.76 when the pasture (Pangola grass) was dry and the animals received a meat and bone meal supplement. After rain and a greening of the pasture, the control group caught up again, but differences in weight gain were not significant.

The benefits of vitamin B12 in the late dry season on improved pasture would be worth further study on the evidence of this trial.

(b) Cobalt 1977-79

A group of 47 two year old steers from Adelaide River had been heavily overstocked in their second Wet season and weighed only 140-200 kg. Thus it seemed likely that their intake of cobalt, which is at a reasonable level in pastures only in the early Wet season (Winter et al. 1977), may have been low. On 21.12.77 the animals were wormed, half were given cobalt bullets and grinders, and they were placed on Pangola grass pasture for the following year.

Results are presented below.

Dates	Mean liveweight gain (kg)	
	+ Cobalt	- Cobalt
21.12.77-4.5.78	102	105
" -26.7.78	111	109
" -18.10.78	106	105
" -2.1.79	157	160

There was never a significant difference between groups. Thus for this group of cattle on Pangola grass there was no benefit gained from the cobalt therapy.

COBALT THERAPY IN ZAMIA TRIALS

In order to induce symptoms of Zamia (*Cycas media*) staggers in cattle, two small feeding trials were done near Darwin in 1965-66. Cobalt bullets were given to some animals, but these provided neither liveweight gain response, nor protection from poisoning.

CSIRO SURVEY AND TRIAL

Dr H.J. Lee of the CSIRO Division of Biochemistry and General Nutrition collected liver and serum samples from cattle in the Top End and Kimberleys in October 1963 to check for vitamin B12, cobalt and copper status. A summary and table of his results are presented here.

Vitamin B12 in liver averaged 1.3.-2.5 µg/g wet weight, with a lowest sample of 1.1 µg/g. Vitamin B12 in serum averaged 0.26-0.62 mµg/ml, with a lowest sample of 0.09 mµg/ml. Cobalt in liver averaged 0.40 (0.28-0.71) ppm dry matter. Dr Lee concluded that the cobalt/Vitamin B12 status was adequate at all the sampling sites.

The copper in liver dry matter average values were 45-180 ppm, with a low of 27 ppm, except for steers form a site 100 km S.W. of Darwin which had 27 (7-67) ppm. Steers from Katherine Research Station had higher liver copper, with a range of 64-366 ppm. Dr Lee concluded that the copper status was shown to be adequate except for perhaps the one group.

The animals at Katherine Research Station were in a trial on native pastures which indicated no liveweight response to cobalt and copper supplementation over a three year period (mentioned in Norman and Stewart 1964).

Vitamin B12 in liver (µg/g wet weight) and in serum (mµg/ml), and cobalt and copper liver (ppm dry basis) - summary of mean values and range. H.J. Lee 1963, N.W. Australia Survey

SAMPLES	VITAMIN B 12		COBALT	COPPER
	Liver	Serum	Liver	Liver
KATHERINE 31.10.63				
	+ Cobalt			+ Cu:
Exptl. cattle at CSIRO 4-mile Farm	2.3 (1.7-2.7)	0.52 (0.31-0.78)		171 (106-354)
	No Co 2.5 (1.9-3.0)	0.62 (0.48-0.83)		(64-366)
Exptl. cattle at NTA 15-mile Farm	1.6 (1.4-2.1)	0.40 (0.21-0.64)		82 (61-131)
DARWIN 8.11.63				
Beatrice Hill: Exptl. steers	1.9 (1.6-2.3)	0.29 (0.19-0.51)		45 (27-83)
Buffalo Bulls	1.2 (1.2-1.3)	0.48 (0.39-0.64)	*0.38	89 (28-131) *Also 121 & 159
"Tortilla Flat", Upper Adelaide River	1.8 (1.7-2.2)	0.26 (0.12-0.55)		180 (160-234)
Abattoirs: ex "Meneling" near Rum Jungle: Steers	1.3 (1.1-1.6)	0.27 (0.09-0.45)		27 (7- 67)
KIMBERLEY AREA 4.11.63				
"Ivanhoe": Scrub bulls	1.7 (1.3-2.5)	0.46 (0.26-0.61)	*0.40 (0.28-0.71)	*106 (36-224)
Steers	1.1	0.43		53
Research Station: Dairy Cows	1.3 (1.2-1.4)	0.46 (0.22-0.82)		150 (83-184)

* Whole liver samples. Other analysis on liver biopsy samples

N.B. "Normal" liver contains more than 0.5 µg/g vitamin B12 wet liver and more than 0.1 ppm cobalt (Lee).

Serum levels less than 0.2 mµg/ml vitamin B12 indicate cobalt deficiency is likely (Underwood 1971).

COPPER AT LITCHFIELD

Department veterinarian Erryl Pitt observed indications of copper deficiency at a site 150 km S.W. of Darwin.. Weaners were reported to show slow growth, chronic diarrhoea and hair depigmentation. Copper content of liver dry matter averaged 34 ppm, but 25% of bullocks had less than 20 ppm copper. However these levels do not necessarily establish copper deficiency.

COPPER IN LIVER FROM MT. BUNDEY

In 1979 liver samples from cattle grazing low quality improved pastures on very poor soils at Mt. Bundey Station about 70 km south of Darwin were analysed for copper by Dr J.P. Langlands of CSIRO. Two sets of samples averaged 47±3 and 160±46 ppm respectively, in liver dry matter. Thus none of the samples showed any evidence of copper deficiency.

SOME COBALT AND COPPER LEVELS IN PASTURES IN THE NORTH

(a) Wesley-Smith near Adelaide River in May 1970 had total dry matter from plots with 85% Townsville stylo analysed for copper and other elements.

Copper levels in plant dry matter were 7-10 ppm from floodplain solodised solonetz and 22-31 ppm from upland yellow earth.

Samples for cobalt analysis must be taken with great care to avoid dust and machine contamination and were not possible in this case.

(b) Wesley-Smith, Heap and Jeffery measured copper levels in Verano stylo plots in mid-April 1980 on two soils near Adelaide River; a yellow earth which had been extensively harvested for hay and a gravel lithosol. Treatments included plus or minus a general trace element dressing which included cobalt and copper applied to the soil.

Copper levels of Verano whole plants ppm dry matter were as follows:

	+ Trace	- Trace	Sig.
Yellow earth	6.5 ± .2	6.4 ± .2	N.S.
Gravel	7.3 ± .2	6.5 ± .2	N.S.

(c) Mt. Bundey Station made monthly measurements of some mineral levels in leaf samples of three native perennial grasses in 1979-80 as follows:

Average levels of copper as ppm of dry matter

Oct	Nov	Dec	Jan	Feb	Mar	May	Sept	Oct	Nov
22	100+	100+	8	14	22	13	12	12	15

(d) Winter et al. (1977) at Cape York (Queensland) measured cobalt and copper levels as ppm in dry matter of Guinea grass and Stylo as follows:

		Jan	Feb	Mar	June	Nov
Cobalt	Grass	0.13	0.13	0.005	0.005	0.005
	Stylo	0.07	0.03	0.02	0.005	0.005
Copper	Grass	4.8	4.6	5.0	4.5	3.2
	Stylo	8.5	6.6	7.0	5.0	

SOIL STUDIES

In general very little pasture response to any trace elements has been achieved on soils in the Top End of the N.T.. Zinc deficiency has been indicated in some areas as the first trace element to show up.

Copper applied to the soil has given improved pasture growth responses in several localities in the Top End, generally on sandy soils (G. Calder, pers.comm., 1981).

The need for extra cobalt has not been shown.

CONCLUSION

Whilst it is tempting to look for easy solutions to poor cattle growth in the Top End by implicating various trace elements, the chief nutrient deficiencies are obviously nitrogen (protein) and energy.

It is important to determine the adequacy of minerals, but in the Top End (north of Katherine) it is contended that this should be done primarily in situations where animals are grazing improved pastures and have gone some way towards fulfilling their basic feed needs. This is because cattle grazing native pastures alone generally gain weight only for the first 3 or 4 months of the Wet season and lose weight throughout the Dry (Wesley-Smith 1972) on the very poor native pastures available over much of this region.

Gartner et al. (1980) reviewed mineral deficiencies in tropical Australia and concluded that these are more widespread in grazing animals than previously recognized.

For cobalt, Underwood (1971) indicated that about 0.07 ppm cobalt in the dry matter of the diet of sheep should avoid deficiency, whilst cattle may tolerate as low as 0.05 ppm depending on other dietary factors.

Unfortunately there is insufficient data on pasture levels of cobalt to make a judgment, but the sufficiency of this is probably best judged from the animal studies reported earlier. These do not indicate cobalt deficiency, though one trial showed a small response by cattle to vitamin B12 in the late Dry season.

The Cape York figures are included to show that adequate levels of cobalt exist in the pasture only in the first months of the Wet season. The animal would have to rely mainly on liver reserves for the rest of the year, so it would be important not to restrict its grazing in those vital first months of the Wet season.

For copper, Underwood (1971) indicates that ruminants require 4-6 ppm copper in diet dry matter, but this can be markedly affected within about 1-10 ppm depending on other dietary factors.

Thus measured levels of copper in pasture in the Top End appear to be adequate, but further studies will be needed to confirm this, especially on improved pasture.

Dr Langlands (pers.comm.) commented that arbitrary standards for copper in the diet of cattle were set by the Victoria Veterinary Research Institute at Parkville and have been widely adopted.

These are as follows, in mg copper/kg liver dry matter (ppm):

low	5
mod. low	6-15
normal	16-500

On this basis none of the samples analysed from the Northern Territory showed any evidence of copper deficiency.

Thus from the information drawn together here, the cobalt and copper status of animals in the Top End appears to be adequate, or at least not grossly deficient. This is not to say that further studies on native and improved pastures and at different times of the year would not be warranted. The growth response reported to vitamin B12 injections in the late Dry season with cattle on Pangola grass needs confirmation and explanation by future study.

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