Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

Journal of the Department of Agriculture, Western Australia, Series 3

Volume 7
Number 2 *March-April, 1958*

Article 14

4-1958

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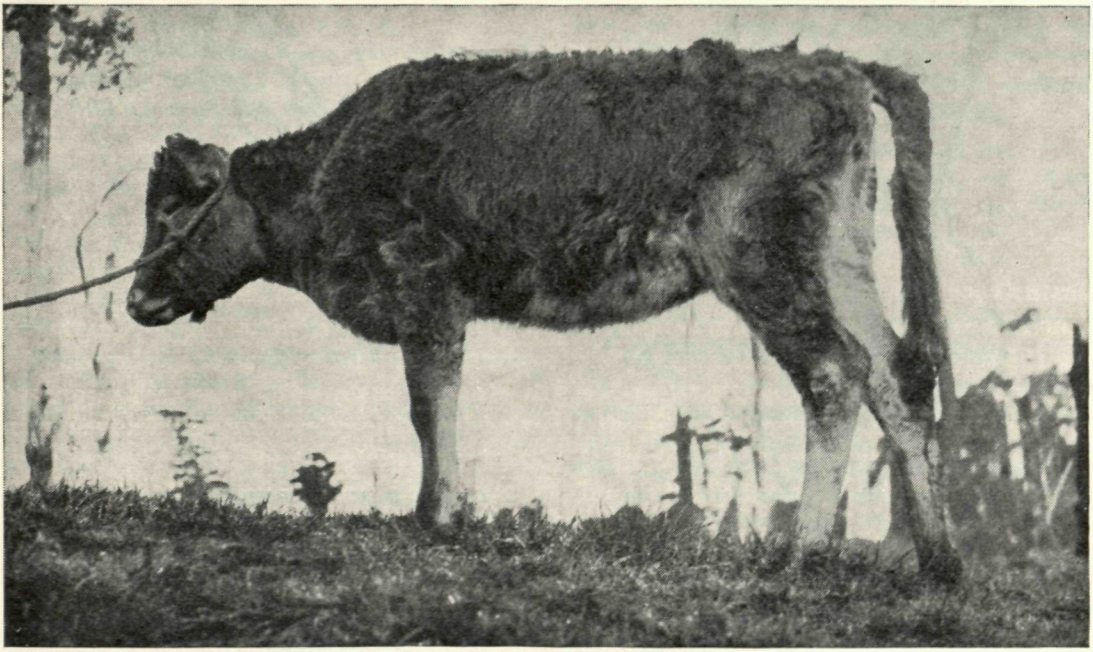

Fig. 1.—A heifer suffering from cobalt deficiency

COBALT DEFICIENCY OF STOCK IN THE BUSSELTON-AUGUSTA REGION

By R. HARLEY[1] and A. B. BECK[2]

DURING the past decade evidence has accumulated which indicates that large areas of country south of Busselton are deficient in cobalt. This information has been spread verbally by officers of the Department of Agriculture through personal contacts and at field days, but so far no information has been published concerning the extent and degree of the deficiency. The purpose of this article is to place on record the clinical and chemical investigations carried out since 1944.

Cobalt deficiency in Western Australia was first confirmed by Underwood and Filmer in 1935, in ruminants grazing on the karri soils of the Denmark area. Subsequent investigations carried out by the Veterinary Branch of the Department of Agriculture showed that clinical evidence of deficiency could be found in cattle and sheep grazing on the shelly sand-hill soils along the coast from Broom to Esperance. It was also found that the banksia-tuart sands inland from the west coast are deficient in cobalt to a variable degree. In some places (e.g. Muchea and Maida Vale) severe symptoms have been seen in stock, but in other places only a moderate deficiency appears to exist.

In the extreme South-West the first indications of possible cobalt deficiency were obtained in 1943 during the investi-

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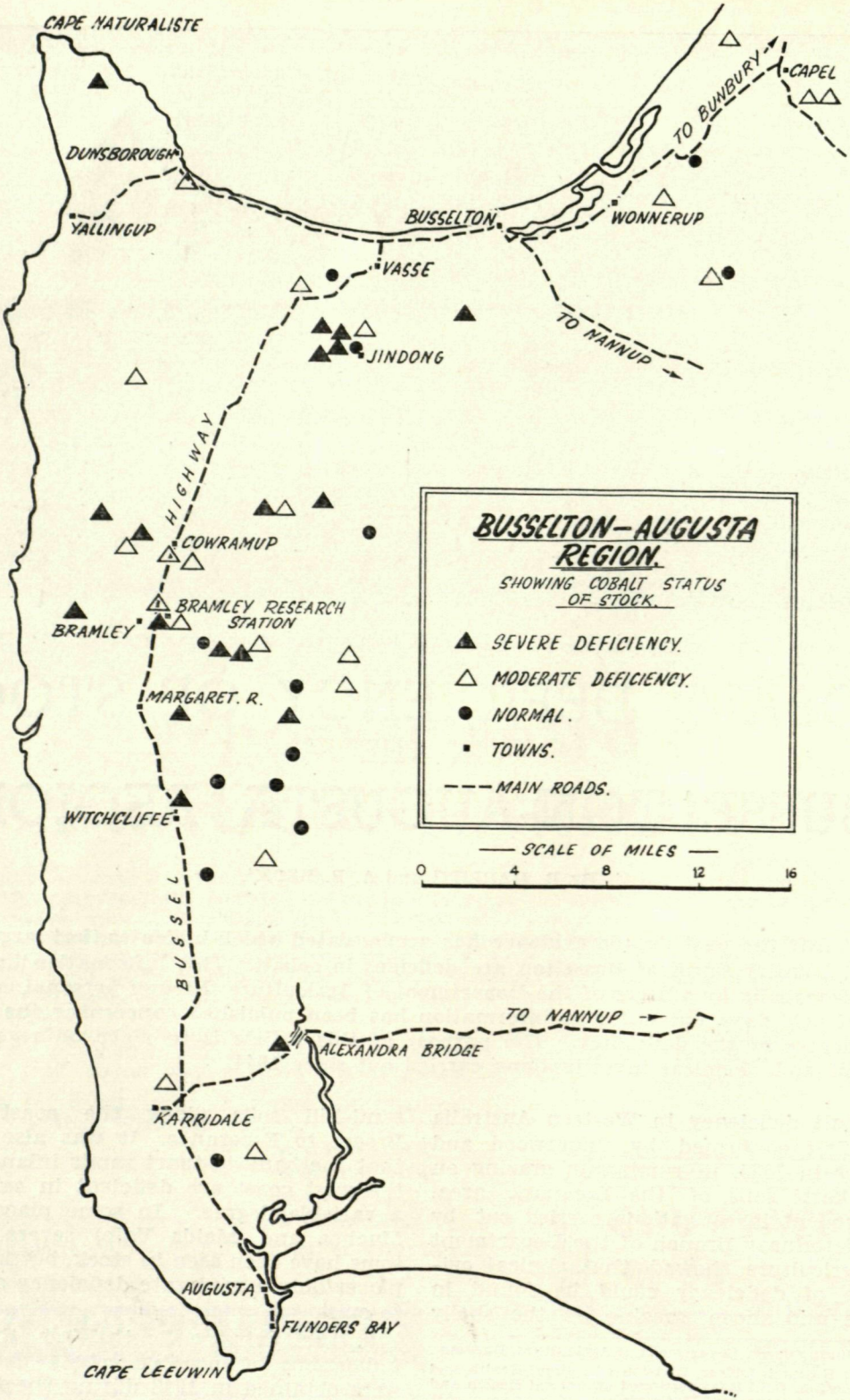
CAPE NATURALISTE
DUNSBOROUGH
YALLINGUP
BUSSELTON
VASSE
JINDONG
WONNERUP
CAPEL
TO BUNBURY
TO NANNUP
HIGHWAY
COWRAMUP
BRAMLEY RESEARCH STATION
BRAMLEY
MARGARET. R.
WITCHCLIFFE
BUSSELL
TO NANNUP
ALEXANDRA BRIDGE
KARRIDALE
AUGUSTA
FLINDERS BAY
CAPE LEEUWIN
BUSSELTON–AUGUSTA REGION.
SHOWING COBALT STATUS OF STOCK.
SEVERE DEFICIENCY.
MODERATE DEFICIENCY.
NORMAL.
TOWNS.
MAIN ROADS.
SCALE OF MILES
0
4
8
12
16

gation of copper deficiency in cattle and sheep. In experimental animals no symptoms of cobalt deficiency were noted, although low levels of cobalt were found in livers of some of the animals. Subsequent clinical observations in the field indicated a cobalt deficiency throughout the region. This deficiency has been confirmed both by chemical analysis of liver samples and by the response to cobalt feeding. Such confirmation is essential because the symptoms of cobalt deficiency, particularly in mild cases, are not sufficiently characteristic to enable the establishment of a firm diagnosis. During recent years clinical evidence of cobalt deficiency appears to have increased throughout the region.

The data have been summarised in the accompanying map. The results of chemical analyses have been used to grade the degree of the deficiency although there has not always been the expected correlation with clinical signs. Generally a "severe deficiency" rating indicates obvious symptoms in stock such as wasting in both sheep and cattle and rheumy eyes in sheep. In the case of "moderate deficiency" there may be no symptoms definitely indicating deficiency disease but the growth of young stock is retarded, adult cattle do not thrive and animals improve when cobalt is supplied.

In some instances copper deficiency has also been encountered but, generally speaking, copper-containing fertilisers have been used throughout the region, which is known to be severely deficient in copper.

DISCUSSION OF RESULTS

It will be seen that evidence of both severe and moderate deficiency has been encountered over a very wide area. As the soil types are similar throughout the region, it is probable that the whole belt of country from Cape Naturaliste to Cape Leeuwin is deficient in cobalt. It is not known how far eastward this belt extends but symptoms have been observed in stock for at least three miles east of the Bussell Highway.

In some areas of severe deficiency (e.g. west and north-west of Margaret River) the soil types are apparently derived from

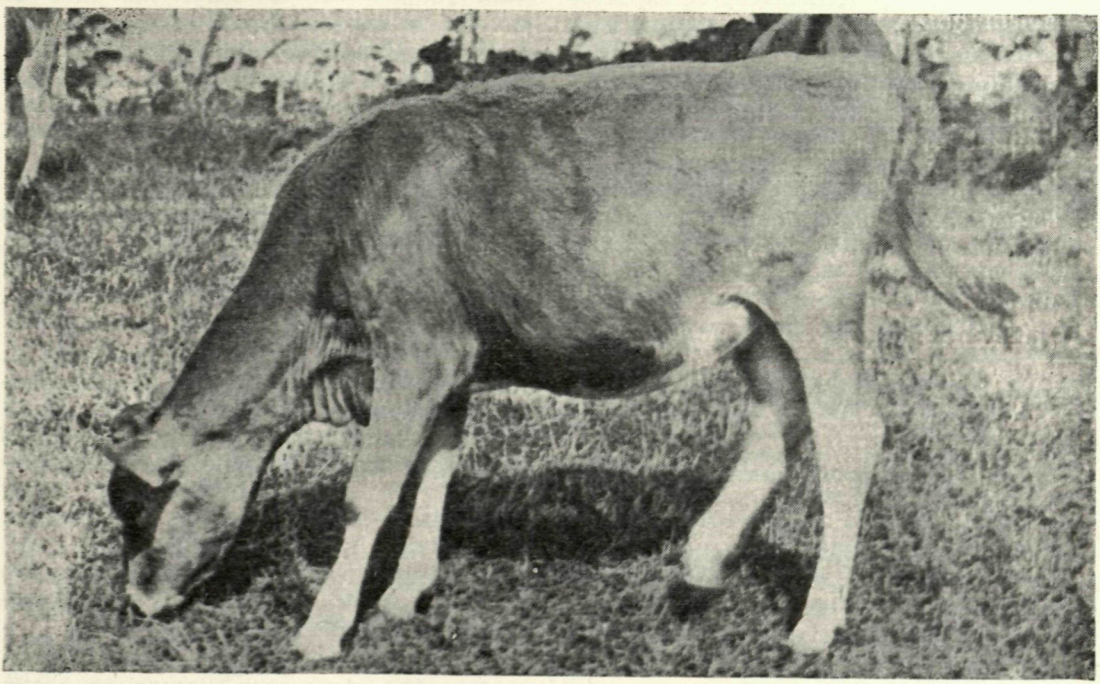

Fig. 2.—The same heifer showing improvement in condition, following upon cobalt supplementation

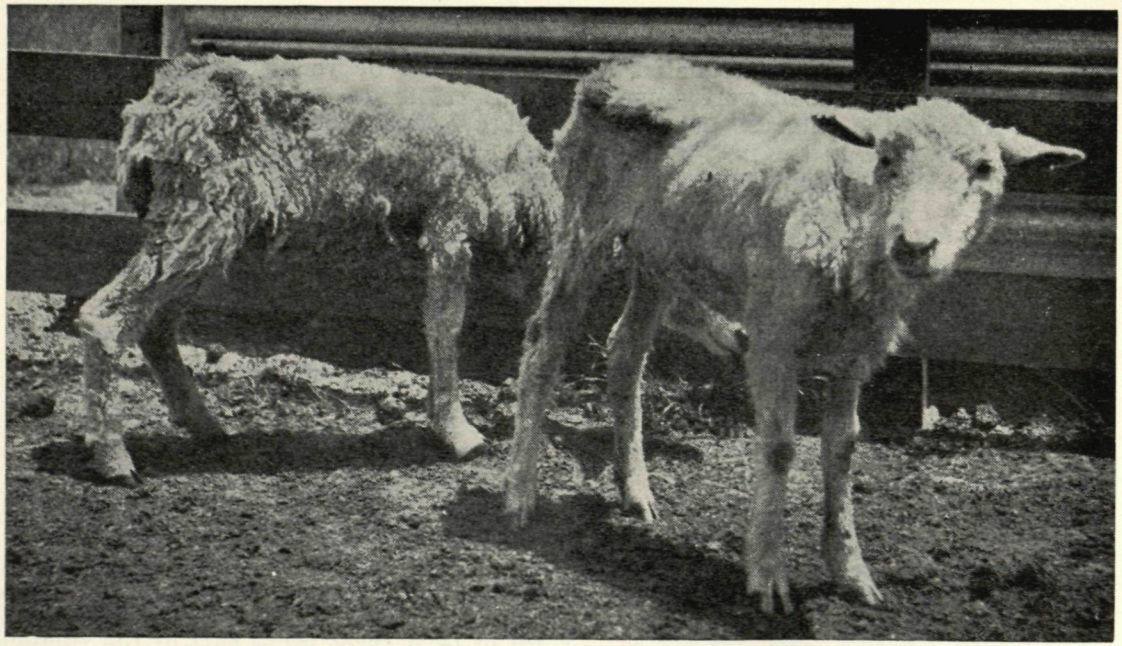

Fig. 3.—Sheep suffering from cobalt deficiency

shelly sand-hills nearer the sea where "coast disease" has been known for many years. Many other properties are on light sandy soil types which might be expected to be deficient even though similar soils inland do not appear to show cobalt deficiency. One surprising feature of these investigations is that the deficiency has been observed on ironstone gravel soils (laterites). Hitherto it was thought that such soils would contain adequate cobalt. It is not known whether the levels of cobalt are low in the lateritic soils of this region or whether it is present but not available to pasture plants. Recently, cobalt deficiency has been confirmed in stock grazing on some lateritic soils of the Darling Ranges and it is possible that other similar soils elsewhere may be found to be deficient.

Although no controlled experiments have been made in the Busselton-Augusta region, beneficial results have been claimed where cobalt has been used. At the Bramley Research Station some heifers were placed on pasture which, although severely deficient in copper, had been topdressed with cobalt suphate only; other heifers of the same age were run on the paddocks which, at that time, had received copper fertiliser but no cobalt. In spite of a very low intake of copper, the animals on the cobalt-treated paddocks were judged, for at least the first 18 months, to show much better growth and condition than those receiving no cobalt. Subsequent treatment of all paddocks with cobalt has resulted in an evident improvement in the condition of all stock.

RECOMMENDATIONS

It is recommended that the cobalt status of all country extending between Cape Leeuwin and Cape Naturaliste and inland to three miles east of the Bussell Highway should be regarded as marginal.

The symptoms of cobalt deficiency in stock have been described in Departmental Bulletins 2172 and 2227 but certain diagnosis is not easy. Very mild cases may pass unnoticed, and other diseases may give symptoms identical with those of moderate to severe cobalt deficiency. Farmers who suspect that their properties are deficient in cobalt should contact the Veterinary Office, Department of Agriculture, Bunbury.

At present the easiest method of preventing the deficiency disease in cattle and sheep is to topdress with cobalt-

containing fertilisers or to spray pastures with an equivalent amount of cobalt sulphate or chloride solution. Topdressing will probably not be effective on soils containing shell fragments. Details of topdressing and other methods are given in the previously mentioned Bulletins. It should be pointed out that, although simple, topdressing of pastures is an exceedingly wasteful method for supplying cobalt to stock. Only a very small fraction of the cobalt applied becomes available to the animals because of the low degree of absorption of cobalt from the soil by pasture plants. The newly developed cobalt "bullets" will probably prove to be the most economical method for supplying the element to sheep. These "bullets" have not yet been used commercially on cattle.

TECHNICAL APPENDIX

Cobalt was estimated in liver samples by the nitroso-R-salt method of Marston and Dewey (Aust. J. exp. Biol. & med. Sci., 1940 - 18 : 343). A preliminary extraction of cobalt was made with nitroso-naphthol and chloroform, in earlier samples by the method of Beck (*ibid* 1945 - 23 : 311) and later by an unpublished method of Dewey and Marston.

In the compilation of the map, the following levels of liver cobalt, both for sheep and cows, were used:—0.10 p.p.m. and above, "normal," from 0.09 to 0.05 "moderate deficiency," and below 0.05 p.p.m. "severe deficiency." All values are on a dry weight basis, and, except in the case of livers which were obviously fatty, are not corrected for fat content. Except in the case of the Jindong Experimental Farm, from which some 20 samples were analysed, each circle or triangle represents a single liver sample. Unless supported by unequivocal clinical signs and response to cobalt feeding, figures for the livers of very young animals have not been used.

The results for the livers from Jindong are described by Bennetts, Beck and Harley (Aust. vet. J. 1948 - 24 : 237). No explanation can be given why clinical signs of cobalt deficiency were not observed in experimental animals. Similar results have been obtained from the Bramley Research Station where apparently normal cattle have shown very low levels of cobalt in the livers.

Few pastures have been analysed because of greater difficulties in the analytical methods. The results obtained, however, confirm the existence of cobalt deficiency. Five samples from the Jindong, Metricup, Cowaramup, region showed a mean value of 0.05 p.p.m. Co on dry matter (range 0.03 to 0.06 p.p.m.). Samples from two farms at Karridale gave values of 0.04 and 0.09 p.p.m. Three samples from Treeton (about 6 miles east of Cowaramup) gave values of 0.04, 0.03 and 0.12 p.p.m. Thirteen samples from the Bramley Research Station and a neighbouring farm showed a mean value of 0.03 p.p.m. with a range of from less than 0.01 p.p.m. to 0.07 p.p.m. Values of 0.10 p.p.m. and above are regarded as "normal" for pastures.