A SURVEY OF THE INCIDENCE OF COPPER DEFICIENCY IN DAIRY CATTLE IN COASTAL QUEENSLAND SOUTH OF BRISBANE.

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SUMMARY.

Copper deficiency in dairy cattle has been diagnosed over most of the lower watersheds of Queensland rivers south of Brisbane by analysis of livers from slaughtered animals. Blood copper concentrations were also used as an index for a few properties from which livers were not available. Samples were obtained from 127 properties, of which 95 were copper deficient.

There is a correlation between the distribution of alluvial soils in this area and the incidence of copper deficiency in cattle. It is postulated that the low fertility of these alluvial soils and the dominance of narrow-leaved carpet grass (Axonopus affinis) **may account for this correlation.**

I. INTRODUCTION.

Lee and Moule (1947) first drew attention to the presence of copper deficiency in livestock in Queensland, indicating that it was widespread and of some economic importance in sheep-raising areas.

Harvey (1952) reviewed data on the extent and distribution of copper deficiency in both sheep and cattle areas of the State. He used two main criteria to assess the incidence of copper deficiency in sheep, viz., the characteristic and specific wool lesion, "straight or steely" wool, and the copper concentration present in both liver and blood.

Where cattle are concerned, no single clinical symptom is recognized as specific for copper deficiency. Confirmation of deficiency depends on biochemical analysis. Blood copper levels are a useful indication but liver copper concentration is more satisfactory as it shows the copper reserves in the animal.

Using these criteria, Harvey (1952) defined 11 localities in Queensland where copper deficiency in cattle occurs. One of these is the coastal area south of Brisbane. The river flats in this area are largely devoted to dairying. Although the lower reaches of the rivers receive an average annual rainfall of about 40 in., portion of the catchment receives as much as 80 in. per annum, and extensive flooding occurs during the wet season in many years. Near the mountain ranges, dairy-farmers grow forage crops for their cows, but nearer the coast, the arable land is devoted to cash crops rather than forage crops.

With a dairy cow population of approximately 40,000 on 750 farms, this area is one of the chief centres of milk supply for Brisbane. Production per cow, however, is not satisfactory, being the lowest of all districts contributing to the Brisbane milk supply. It is also low when compared with production in other dairying districts of the State. Pegg (1956) reported that the average production per cow for all cows in herd recording groups in Queensland during 1954-55 was 3,486 lb. milk, equivalent to 150 lb. butterfat. During this same period the average production per cow for two herd recording groups in south coastal Queensland was 2,783 lb. milk, equivalent to 112 lb. butterfat, and 2,679 lb. milk, equivalent to 112 lb. butterfat.

A wasting disorder, often associated with severe scouring, is seen even in periods of good pasture growth. Deaths of cattle suffering from this disorder have been recorded. Infertility is a problem and on some properties there has been a high incidence of brucellosis. Losses of calves and young growing stock are so high that on many properties the maintenance of herd numbers is only possible by the introduction of adult cattle. The incidence of parasitic gastro-enteritis in one portion of this area was described by Roberts, O'Sullivan and Riek (1952), who stated that mineral or trace element deficiency, if they exist. could play an important part in the host's susceptibility.

The operation in the area of a tuberculin testing programme, which included the destruction of all positive reactors, presented an opportunity for the collection of material at autopsy. A detailed survey of the incidence of copper deficiency in dairy cattle within this area could thus be made. The results of this survey are presented below.

II. METHODS AND MATERIALS.

Positive reactors to the tuberculin test were killed under supervision. A portion of the liver was collected from animals whose livers showed no macroscopic abnormalities. Where a large number of reactors came from one property, liver sampling was limited to six animals.

On several properties all the cattle tested gave a negative reaction to the tuberculin test. Some of these properties were visited subsequently and blood samples taken for copper analysis. Using stainless steel needles washed in glass-distilled water, blood was drawn from the jugular vein into copper-free bottles containing potassium oxalate. Copper was determined in both liver and blood, using the method of Clare, Cunningham and Perrin (1945).

III. RESULTS.

The results are shown in Table 1. The area has been divided into three zones marked 1, 2 and 3, which represent districts covered by each of the three veterinarians carrying out the tuberculin tests. Liver copper

concentrations of less than 30 p.p.m. were classed as copper-deficient; blood copper levels of 0·05 mg. or less per 100 ml. were considered indicative of copper deficiency (Cunningham 1946).

Table 1.

ANALYSIS OF FARMS ON THE BASIS OF COPPER DEFICIENCY.

Zone.	Farms in Zone.	Farms Represented in Tests.	Copper Deficient Farms.		Farms Not Copper Deficient.	
			Number.	Per cent.	Number.	Per cent.
1	311	34	23	67·6	11	32·4
2	223	53	37	70·0	16	30·0
3	210	40	35	87·5	5	12·5
Totals	744	127	95	74·8	32	25·2

Table 1 shows that there is a high incidence of copper deficiency in grazing cattle in the area. Low liver or blood copper levels were found in cattle from 95 of the 127 farms examined. Fig. 1, which shows the distribution of these properties, indicates that there is a close relationship between copper deficiency in cattle and alluvial soils in this area.

IV. DISCUSSION.

Skerman (1952) mapped the alluvial soils of south-eastern Queensland. He described those in the area covered by this survey as being derived from tertiary basalts of the main range in the hinterland. These soils are periodically inundated by floods and drainage is a serious problem. They range from acid to strongly acid in reaction and are of low fertility. This, together with poor pasture management, has led to the invasion of sown pastures of paspalum (*Paspalum dilatatum*) and white clover (*Trifolium repens*) by narrow-leaved carpet grass (*Axonopus affinis*). White clover has persisted rather more than paspalum, but both are now dominated by the more aggressive carpet grass. This is particularly true in the alluvial areas towards the mouths of rivers, where drainage is a major problem.

Chester, Marriott and Harvey (1956) showed that narrow-leaved carpet grass has a lower copper content than paspalum and white clover grown on the same soil type and in the same locality about 60 miles north of Brisbane.

There are some anomalies which appear to contradict the general correlation between the distribution of copper deficiency and alluvial soils in this area. On a few properties the original sward of paspalum and white clover

has been maintained by careful pasture management. Other isolated cases of normal copper values in liver and blood of animals have been attributed to (*a*) the use of bought concentrates and roughages as supplementary feeds, (*b*) the use of relief country in non-deficient areas, and (*c*) introduction of cattle from other districts as replacements to maintain herd numbers.

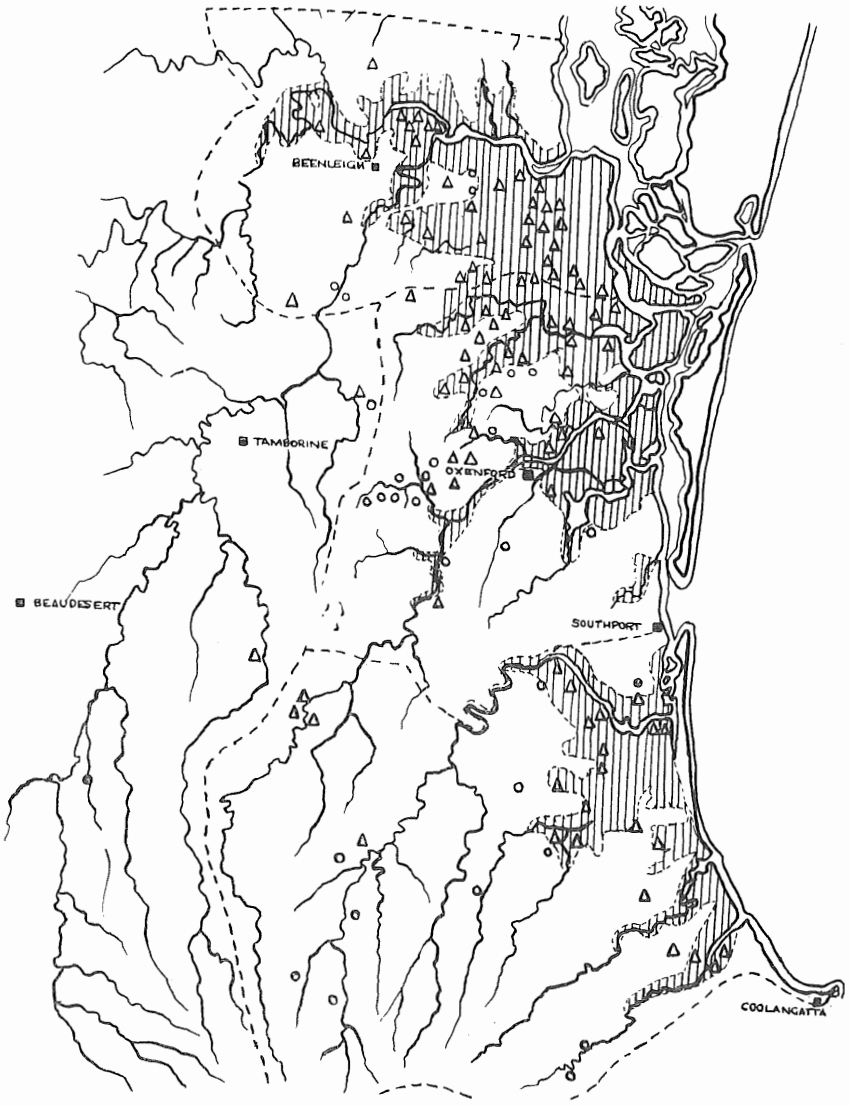

Fig. 1.

Map Showing Distribution of Properties from Which Samples Were Taken. The shaded portions indicate alluvial areas.

O Normal Levels for blood or liver copper.

Δ Low levels for blood or liver copper.

There is little precise information on the effect of copper deficiency on either total milk production or butterfat content of milk. This study may indicate some relationship, as the dairy cattle in this area are among the lowest milk producers in the State. Further investigation of corrective measures applicable to the area and of the effect of copper supplementation on production is necessary.

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