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Laurence C. Snook

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COBALT — Its Use to Control Wasting Disease

By L. C. SNOOK, D.Sc.,
Animal Nutrition Officer

INTRODUCTION

Thirty years ago two research workers in the West Australian Department of Agriculture—E. J. Underwood and J. F. Filmer—were making an intense study of a mysterious disease which threatened ruin to dairy farmers in the Denmark-Walpole districts. Excellent pastures were being grown on the newly-cleared land but on many properties the cattle lost their appetite and wasted away, despite an abundance of what appeared to be most attractive grazing.

This "Denmark wasting disease," as it was called, resembled a disease known as "bush-sickness" which was causing serious losses among sheep and cattle in New Zealand. Anaemia was a characteristic feature in affected animals and the New Zealanders found that the disease could be cured by feeding a finely ground iron ore known as limonite. This limonite also cured "Denmark wasting disease" but the West Australian workers could not associate the disease with a lack of iron.

Tests with carefully prepared extracts showed that it was the traces of cobalt in the iron ore which prevented "wasting disease." This finding has proved to be of immense value to farmers all over the world. In Europe and America, for example, it was found that a whole series of historic "ill-thrifts" which had plagued sheep and cattle for hundreds of years, resulted simply from an inadequate intake of cobalt.

Although the work which led to these discoveries was carried out 30 years ago, serious losses are still being suffered in Western Australia as the direct result of cobalt deficiency. These losses continue to occur, partly because we have been too ready to assume that we knew all about cobalt deficiency, and partly because farmers have neglected to make full use of the knowledge available. The losses which result from lack of cobalt can be very costly and on any farm where there is any suggestion of unthriftiness in sheep or cattle the possibility of cobalt deficiency should receive serious consideration.
FOR many years it was assumed that in Western Australia cobalt deficient areas were restricted to a coastal fringe which rarely extended more than 20 miles inland. This has proved a costly false assumption. During recent years cobalt deficiency has been diagnosed over extensive areas of inland country.

No longer is it safe to assume that cobalt deficiency is restricted to any particular soil type. Wasting disease has been seen on typical ironstone country in the Darling Ranges, and on first class jarrah-redgum soils in the Boyup Brook-Kojonup districts.

Most surprising has been the response to cobalt seen on some old established properties with rich soil, where apparently healthy stock have been reared over a long period.

Deficiency diseases can become progressively worse over the years, either because limited reserves of an essential element become exhausted, or because with heavier stocking, demand exceeds supply. Cobalt deficiency may also appear on properties previously considered "sound" because the lush green herbage typical of highly improved pasture can contain less cobalt than some slower growing, less productive species.

Legumes in general are richer sources of cobalt than are grasses. Deep rooted perennials such as lucerne contain more than shallow rooted annuals.

Cereal hays and grains can be deficient in cobalt, even when grown on "sound" farms. It is for this reason that symptoms of cobalt deficiency are sometimes seen in sheep or cattle which have been placed in pens, and given an all-cereal ration in preparation for a show or a sale. Research workers have also run into trouble when they have kept experimental sheep in pens on a cereal diet. In all such cases it is essential to provide ruminants with a mineral supplement containing cobalt, if loss of appetite on a cereal ration is to be avoided.

**SYMPTOMS OF COBALT DEFICIENCY**

Wasting disease is an excellent descriptive name. In the absence of cobalt, ruminants lose their appetite and literally waste away from starvation.

In cattle the lack of appetite can be accompanied by a depraved appetite for rubbish such as bark, sticks and earth. The coat becomes long and rough with a characteristic "wasty" appearance. In calves, scouring can become quite severe. Milk production is depressed and conception rates can be poor.

Sheep develop "weepy eyes," which serves as a fairly dependable diagnostic feature. In both cattle and sheep the animals develop the appearance generally associated with severe infestation with worms.
As the disease progresses the animals can become seriously anaemic.

On many properties where the mature animals appear quite healthy, symptoms of cobalt deficiency can be seen in calves and lambs, which remain unthrifty and fail to grow.

Losses among weaners may be considerable on properties with a marginal deficiency.

Infertility in cows can become a serious problem in herds on pasture which is deficient in cobalt. This was illustrated very clearly in a beef Shorthorn herd in the Mayanup district which was investigated because of delayed conception in the older cows, and infertility in the heifers. Analyses showed that the livers and the pasture contained sub-optimal amounts of cobalt. Supplements have now been supplied for several years during which calf drops have been excellent; the calves have grown into much bigger beasts and wasty coats have completely disappeared.

Filmer and Underwood (1936) in one of their early papers give the following hints to assist in determining whether a disease characterised by loss of condition is wasting disease:

(1) Wasting disease occurs in the presence of ample feed, and is most common when the feed is green.
(2) Horses are never affected with wasting disease.
(3) Young cattle, especially those between six and 18 months, are more susceptible to wasting disease than mature cattle.
(4) Sheep, and lambs especially, are more susceptible to wasting disease than young cattle.

**DIAGNOSIS OF COBALT DEFICIENCY**

Cobalt deficiency can be diagnosed by analysing the pasture available to the grazing animals.

Only a mere trace of the element is required—as little as one part of cobalt in each ten million parts of dry matter is adequate. In the affected areas of Western Australia, however, the untreated pasture does not supply even this infinitesimal amount.

Pasture analyses are not favoured for routine checks, as the method is tedious, and improved more rapid methods are now in use.

An accurate diagnosis can be made by analysing liver samples for cobalt. The liver can be obtained from sick animals or from ration sheep which have been grazing on the suspect pasture for six months or more. Special care must be taken to avoid contamination of samples collected for cobalt analyses and most investigators prefer to make the collections personally. It is possible, however to forward detailed instructions to pastoralists or outback farmers, who suspect cobalt deficiency, so that they can collect and prepare a liver for transport to the Animal Health Laboratory. In this way definite information can be obtained.

Techniques have now been developed which permit the determination of vitamin B12 in serum obtained from test animals. The amount of this vitamin present can be used as a measure for the need of cobalt supplements. This method has the big advantage that it is not necessary to slaughter the animal to obtain liver, and it also permits the collection of a series of samples from experimental subjects.

Cobalt bullets, which are discussed in the section dealing with treatment, provide stock owners with a valuable diagnostic tool. For example, if a line of weaner lambs or yearling cattle is not making the growth expected on the feed available, every second one can be dosed with a cobalt bullet and marked for identification. The two groups can then be left to graze together. If, after a month or so, the treated animals appear no better than the controls, it is most unlikely that lack of cobalt is the cause of unthriftiness. If the basic ration is lacking in cobalt the treated animal will show a definite improvement in a matter of weeks.

**COBALT IN RUMINANT NUTRITION**

**Regular Intake Needed**

The food eaten by ruminants must supply a regular intake of cobalt. This requirement is somewhat unusual, because most animals can build up reserves of essential nutrients. For example, sheep can store enough vitamin A, or enough...
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copper, to last them for at least six months on diets quite devoid of these essentials. This is not the case with cobalt, as was demonstrated clearly by trials carried out in South Australia (Lee 1951). These showed that if sheep were given cobalt once a week, they remained in excellent health. In contrast, if the cobalt was given once every three weeks, some of the sheep tended to become unthrifty. When the cobalt was given in one massive dose every five weeks, the sheep developed symptoms of wasting disease and several died.

The cobalt must be supplied into the rumen. Cobalt which is stored in the liver is of no value, nor is cobalt which is injected into the blood stream.

**Why Do Ruminants Need Cobalt?**

Vitamin B12, which contains cobalt, is essential for the continued good health of all animals. Ruminants obtain this vitamin from bacteria which live in the rumen or paunch. In order to manufacture vitamin B12, the bacteria must receive a steady supply of cobalt in the food or water taken in by the animal. This explains why sheep and cattle must be able to obtain regular intakes of cobalt.

Food which is taken into the paunch is “digested” by various micro-organisms which produce a series of fatty acids. In order to change these fatty acids into useful nutrients the ruminant has evolved a complex enzyme system in which vitamin B12 plays a vital role. If this vitamin is in short supply, the complicated metabolic system is upset, the animal loses its appetite and the stage is set for the onset of wasting disease. Regular supplies of cobalt are thus required by cud-chewing animals because of the peculiar demands of rumen function. Other animals such as the horse require Vitamin B12 also, but not to anywhere near the degree of the ruminant. This explains why the horse can remain healthy while grazing on pasture which will produce wasting disease in cattle.

Calves showing marginal cobalt deficiency. This condition often escapes notice and is most costly to farmers.
Prevention of Cobalt Deficiency

The amount of cobalt required to prevent cobalt deficiency is remarkably small. A problem is to find simple methods of supplying the tiny quantities which are required. Because the cost is insignificant it is foolish to run any risk of a deficiency which can cause such serious losses.

In the field it is most unlikely that sufficient cobalt will be supplied to produce toxic symptoms. The main disadvantage of an over-liberal supply is that this is wasteful.

Supplying Cobalt Through the Pasture
The ideal way to provide cobalt to grazing animals is through the pasture. Cobalt is not an essential plant food but on most soils enough of this element is absorbed into the plant tissues to satisfy the requirements of sheep and cattle. If the soil does not supply enough cobalt it is logical to apply the missing element along with ordinary fertiliser.

Cobalt in Fertilisers
In New Zealand and in Europe it is a standard practice to correct cobalt deficiency by topdressing the soil with a cheap cobalt salt. In Australia, for a variety of reasons, the use of cobalt in the fertiliser has not been strongly advocated.

Some of the early trials were carried out on limestone soils from which the plants were unable to recover any cobalt. These trials aroused doubt concerning the value of cobalt applied in fertiliser.

On other soil types, however, good results have been reported. Thus at Glenroy, South Australia, the topdressing of cobalt sulphate at the rate of 1 lb. per acre (applied once only) proved a simple and economic means of correcting cobalt deficiency in the pasture for at least five years (C.S.I.R.O. Annual Report, 1962).

In New Zealand, trials carried out on granite soils indicated that 1 lb. of cobalt sulphate per acre protected sheep for five seasons (Andrews, 1953).

Most soils in Western Australia are somewhat acid and there is reason to expect that cobalt applied in fertiliser will be effective for at least two or three years. Cobalt is not readily leached from the soil; in fact it is held extremely tightly.

Recent work has shown that cobalt applied to Wanneroo sand is held tenaciously in the top few inches of soil (Ozanne, Greenwood and Shaw, 1962).

The Department of Agriculture has now established test plots on a variety of soil types in cobalt-deficient areas of Western Australia. The object is to determine the length of time during which pasture plants absorb adequate cobalt after the application of varying rates of cobalt sulphate. It is important to know whether it is necessary to apply a few ounces per acre every year, or larger quantities less frequently. Trials carried out on Crawley sand (Rossiter, Curnow and Underwood, 1948) have shown that a serious deficiency of cobalt in pasture can be corrected for two years by the application of 4 oz. of cobalt sulphate per acre.

Much more experimental evidence must be obtained before recommendations concerning the use of cobalt in fertiliser can be given with confidence. Meanwhile farmers in cobalt-deficient areas could be advised to buy one third of their annual supply of fertiliser in the form of cobalt superphosphate.

On the acidic soils characteristic of most farming areas in Western Australia the application of cobalt to one third of the grazing area each year should just about eliminate any danger of cobalt deficiency in the stock.

No extra labour is required to supply cobalt in this way and the cost is not great. For a farmer who normally buys 30 tons of superphosphate each year the 10 tons of cobalt super will increase costs by £22 10s. This is a trivial outlay if it eliminates even a marginal deficiency of this vital element. Within a year or so much more specific information should be available and farmers will be advised accordingly.
Cobalt in Pasture Sprays

Cobalt can be applied to pasture in solutions distributed by a boom spray. On properties where routine spraying is carried out to control red mite and lucerne flea it is a simple matter to add enough commercial cobalt sulphate to the mixture so that about two ounces are applied over each acre. If a paddock is sprayed before haymaking the hay harvested will be an excellent source of cobalt.

Treatment with Mineral Lick

Mineral licks are most effectively used when a known amount can be mixed with the food fed to each animal. One can then be certain that each beast gets enough to correct a specific deficiency.

When "licks" are placed in troughs in the field for stock to help themselves, consumption can be most variable. Some animals will eat a lot, others may eat none at all. Care must be taken to see that a mineral lick is sufficiently palatable to attract all stock without being so tasty that greedy animals eat the lot. It is hard to achieve a happy medium. There is also the ever-present danger that farmers will neglect to replenish supplies of lick in the field, or that they will allow the containers to become dirty and unattractive. It is not sufficient merely to make a lick available to stock—it is equally important to be certain that all the animals eat a reasonable amount.

Denmark Cobalt Lick

This particular lick has proved useful in the correction of cobalt deficiency.

It is based on limonite iron ore, which contains at least 500 parts per million of cobalt. The limonite is mixed with 38 per cent. stock salt, along with enough blue-stone to correct copper deficiency. Sheep require about an ounce of this lick per head per week and cattle require about an ounce a day. On many dairy farms it is the practice to add Denmark cobalt lick to the feed to cows in the bails and to calves being reared. A disadvantage of Denmark lick is that its high iron content may reduce the availability of phosphorus in the ration. Cheaper and simpler sources of cobalt are now available, and it is likely that Denmark lick will soon be replaced.

Cobalt and Salt

Cobalt can be supplied by mixing one ounce of commercial cobalt sulphate (or commercial cobalt chloride if this is as cheap) in 100 lb. of salt.

To do this, dissolve the cobalt in water and spray the solution over the salt, which can then be thoroughly mixed. Productive dairy cows benefit from an ounce or two of salt in their daily feed and if treated with cobalt the mixture will serve two purposes. Sheep are fond of salt and this is a good vehicle in which to supply cobalt, if the containers are protected from the weather and receive regular attention.

Cobalt in Commercial Mixture

Most feed stuff manufacturers add cobalt to all commercial lines of feeding stuff. The cost is negligible, so if the cobalt is not needed no harm results. Wherever a stock lick or a feed mixture is prepared by a commercial firm or an individual, cobalt should be added as a matter of course.

Cobalt in Drinking Water

On pastoral properties cobalt can be supplied to stock through the drinking water.

The amount to be used can be based on the fact that one ounce of commercial cobalt sulphate or cobalt chloride contains ample cobalt to satisfy the needs of 100 cattle or 1,000 sheep for a week. In general it can be accepted that 1 oz. of the cobalt salt in each 10,000 gallons of water will satisfy requirements.

Simple mechanical units can be purchased which will add measured amounts of cobalt (and copper) to drinking water. Rough and ready methods of treating drinking water seem to have been reasonably effective on outback properties. On some stations the cobalt is wrapped in cloth so that the bundle can be suspended in a container beneath the water inlet pipe. As the water enters the container the cobalt is leached out of the cloth, thus extending the period during which treated water is available.

Another method is to place the cobalt in a length of copper piping with corks in each end. A number of small holes bored in the pipe permit the slow release of the cobalt into the water.
One ounce of cobalt salt can be dissolved in two gallons of water which is placed in 10 bottles. Each bottle will contain ample cobalt for 100 sheep or 10 cattle for a week. This means that in a paddock containing 100 sheep, one bottle of the solution should be added each week to a water trough served by a ball-cock.

It is important to remember that water must be treated at least once a week to ensure that the stock never run short of cobalt.

There are disadvantages in this method of supplying cobalt. Among these are that cobalt corrodes iron containers, and the salts tend to be precipitated in alkaline water. Of most concern is the fact that after rain, stock may not drink water from a trough for long periods. These disabilities can be overcome so long as stock owners remember them.

Unfortunately there is a tendency to take it for granted that erratic methods of water supplementation are good enough. Such an attitude can lead to losses through cobalt deficiency.

Cobalt “Bullets”

The cobalt “bullet” developed by research workers in the C.S.I.R.O. Laboratories in Adelaide effectively gives a lifelong supply of cobalt to ruminants. The cobalt is given in the form of a heavy pellet which when administered to a ruminant remains in the paunch where it slowly releases a constant supply of cobalt. These bullets are now produced commercially at a cost of 90s. a 100 for sheep (255s. for 300) and 75s. for 25 for cattle. Sheep retain these bullets very well and they can be effective for quite a few years. More wastage can occur with cattle and it is recommended that dairy cows be dosed twice a year.

In parts of South Australia the effectiveness of cobalt bullets has been reduced by the formation of coatings which prevent the release of the cobalt. “Grinders” can be administered along with the bullets to reduce the risk of coating. In Western Australia many bullets collected at the abattoirs have been examined but very little evidence of coating has been seen.

This coating is said to be more likely to occur when lambs or calves are given bullets. If possible, delay administration until near weaning time.

The use of cobalt bullets appeals to farmers who like to take positive action with each individual animal to provide protection against cobalt deficiency. With sheep the results obtained have been most satisfactory. Many graziers who seek to market prime beef also believe it pays to give a “bullet” to steers being prepared for market. With dairy cattle, however, it seems better to top-dress pastures and/or feed a cobalt supplement in the bails.

IN BRIEF

The unthriftiness which occurs in ruminants on a diet lacking in cobalt, is still prevalent in Western Australia.

Over extensive areas borderline deficiencies of cobalt continue to cause losses because the symptoms are not sufficiently severe to attract attention.

Wherever young sheep or yearling cattle become unthrifty while feed appears to be plentiful, the possibility of cobalt deficiency should be investigated.

Under intensive methods of farming the application of cobalt to the pasture in the fertiliser appears to be the best corrective measure.

Cobalt bullets have proved to be most effective with sheep and beef cattle.

The treatment of drinking water with cobalt and the preparation of mineral licks is described.

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