Soils correctly limed, but low in organic matter usually have pastures low in Co, causing calves, and lambs to grow slowly and not 'finish', which is costly for sheep farmers.

This sick looking cow grazing mono-pasture (ryegrass only, because calcium is low so earthworms and clovers are few) on DairyNZ's Lye Farm in October 2008, was supplemented with a chelated bullet, which is bad. Read Chelation in mineral bullets. Despite this she was was still suffering low Co, as shown by the long hair on her neck, mainly because the farm was needing LimePlus with its synergisms and deficient

elements. This cow is also exhibiting symptoms of severely low selenium, as indicated by her low head, muck on her tail, and her tail hanging low because Se deficiency causes weak muscles. The brown, dead-looking hair is a sign of a low copper. The lack of sheen indicates low salt. All these and more are easy to fix by giving Solminix in the drinking water, which costs nothing because its many benefits of cow health and better parasite-free young stock.

Unfortunately, deficiencies are seen in herds in much of New Zealand and in other countries, increased by insufficient LimePlus and too much artificial nitrogen. LimePlus increases earthworms which turn facial eczema causing thatch into humus, which holds Co in the soil. When deficient, shown by a ryegrass analysis, applying 1 kg per hectare of Co sulphate (costs about $50/ha) with LimePlus or fertiliser to soils that are low in humus, so low in Co, doesn't do much good because when humus is low, Co, and some other elements, leach out of the soil, especially if superphosphate is applied because its water soluble sulphur leaches and takes K and other elements with it. (re-word and break into two sentences) This was proved in India, so I tested and confirmed it, but Ruakura disputed it and then at my request, by Massey University twice. (re-word sentence)

Pasture ryegrass analyses and blood testing can confirm Co deficiencies, but the New Zealand establishment (Ruakura, MAF, AgResearch, DairyNZ, LIC, etc.) use only soil tests and to only 7.5 cm deep, which puts them decades behind the best farmers and the rest of the world, where samples are taken much deeper, but is still a waste of time and money. Leaf analyses of ryegrass is accurate in that it shows what the plants get out of the soil, and what the animals are eating.

Soils correctly limed, but low in organic matter usually have pastures low in Co, causing calves and lambs to grow slowly and not 'finish', which is costly for sheep farmers.

Good management to maintain optimal Co will give more clovers which will put more nitrogen in the soil naturally, and improve the pasture feed value, milk production and profit. Optimum Co levels in pasture also improves wool quality.

Read this whole chapter

Co is so important that this chapter is eight pages, all of which should be read, especially now that so-called "worm drench resistance" is wrongly influencing the minds of scientists and others.

Animal deficiencies

Ruminants need a continuous supply of Co to enable them to synthesise vitamin B12. Without B12, they can't produce glucose for energy, so they become lethargic and lose their appetite, which accentuates their susceptibility to problems. Severe digestive problems from poor quality feed or silage chopped very short (less than 5 cm which reduces cud chewing) can also lower vitamin B12 levels.

Measure blood or liver levels and for immediate results inject deficient animals with vitamin B12 and fertilise deficient pastures with Co. Injecting with Co is of no use because it is needed by the rumen micro-organisms daily. Licks containing Co, and frequent drenching are also of little use, but a good soluble mineral mix like Solminix in the drinking water will help because cattle then receive Co daily.

These measures will not, however, completely prevent animal deficiencies if pasture levels are low. When deficient, even mature stock can die very quickly because of the added effect of low appetite. Three cows in the eastern Waikato (not a severely Co deficient area) died, and before the vet could diagnose the reason, three more died on the farm that was very highly stocked and very highly fertilised with N, P and K, but not with Co.

Dry copper sulphate and some other elements can kill, so there is a need to be aware of the risk of deficient animals gorging on toxic minerals.

If Co is low, legumes will not nodulate as well, so pastures suffer low nitrogen. Grazing animals will also suffer from eating pastures that lack legumes and so will miss out on other minerals that clovers contain. See the 'Effects if Very Low column' of the spreadsheet 'Plant Minerals Analysis'.

Many farmers from around the world have told me that they can't grow clovers in their area. Low Co and/or low calcium can be reasons. Read Pastures > Legumes on how to grow them.

Sheep and goats

Sheep and goats need more Co than cattle; young animals need more than old; and some breeds of cattle need more than others. Horses can thrive in Co deficient areas because they don't require very much. Low Co has been a reason for lambs being sold by hill country farmers who can't afford LimePlus so can't fatten them, to those on flat land where organic matter is higher thanks to LimePlus. See Minerals in Soils > Cobalt.

Low Co increases cotting, felting or matting in wool which makes wool fibres hard to separate. Poor nutrition and parasitism have been blamed, but both occur more when Co is lacking.

Lambs won't grow and fatten on even mildly Co deficient pastures because -

- Grass Tetany (hypomagnesaemia) increases due to low Co.
- Increased parasite infestation because of low Co and low B12 levels.
- Insufficient clovers in pastures because they need Co to thrive.
- Insufficient N (protein) in pastures for rapid lamb growth because of low clover nodulation.
- Vitamin B12 deficiency. Ruminants need Co to synthesise B12. Horses make their own.

Animal Co deficiency symptoms include:

- Anaemia (pale skin and pale mucous membranes) - pale gums and pale runny eyes
- Bush sickness in New Zealand
- Pine disease in the UK
- Decreased milk production
- Dull, rough hair
- Enlarged heads

- Head held low, a sign of ill-health and low selenium
- Impaired growth
- Increase in internal parasites and repeated parasite infestation
- Lethargy
- Loss of appetite
- Low conception rate
- Muscular in-coordination, causing a stumbling gait
- Pot bellies in young stock, causing sagging backs
- Rough hair coat with long hair growing on the top of the neck like a mane
- Ruminant ill thrift because they can't synthesise vitamin B12
- Slightly sunken eyes
- Slow growth in young animals
- Still-born young
- Vitamin B12 deficiency
- Weight loss

Animal excesses

Supplementing must be done with knowledge and care. Ruminants are tolerant of high levels of Co in feed, but they can reduce animal iodine, iron and manganese levels.

One mg of Co per kg of body weight (0.000016 oz per lb) has killed calves, and 6 mg of Co per kg has killed cattle. Fertilising with Co avoids this risk and is safer and better than other forms of supplementation.

Some vets and farmers use vitamin B12 injections to overcome Co deficiency, which is typical of health systems that treat the symptoms with injections and drugs rather that fixing the cause. In Meat New Zealand, R & D, 2000 to 2001, it was reported, “We are now sure that the so called optimum liver figures for vitamin B12 in New Zealand are much too high”.

Liver L:B12 mmol per kg should be 600. See the spreadsheet ‘Blood Liver Levels’.

Co toxicities from pastures are rare because cattle can tolerate 50 times the optimum tissue level. However, over-dosing with Co can kill, so should be avoided.

Soil & plant deficiencies

Low Co is often a reason for comments, “I can’t grow clovers here”, or “I can’t finish lambs here”. Applying Co in lime on a Pirongia hill farm allowed the finishing of lambs, resulting in more profit.

Co is leached by the excess sulphur in superphosphate, which has 11% water soluble sulphate, which also leaches selenium.

Legume nodulation is better when Co levels are optimum, so much so that an application of 0.5 kg per ha of Co sulphate (21% Co) gave yield increases of 30% from subterranean clover in Australia.

Clovers need N more than grasses, so make their own, but can't fix it in nodules without enough Co, so when it is low, nodulation and N fixation, and growth, are poor. Excess calcium, magnesium, manganese, iodine or iron, and forced fast growth using N, can lower Co uptake by plants.

Different species have different optimal levels. For optimum growth and ruminant health, minimum levels should be: mixed pasture 0.13 mg/kg, clovers 0.2 mg/kg, Cocksfoot (Orchard grass) 0.1 mg/kg, Kikuyu 0.15 mg/kg, ryegrasses 0.12 mg/kg, Timothy 0.1 mg/kg, Tall Fescue (Festuca arundinacea) 0.1 mg/kg and Velvet Grass also called Yorkshire Fog (Holcus lanatus) 0.04 mg/kg.

Pasture levels are usually lower in dry weather. Fast growing and summer pastures, especially if N boosted, have less Co than the same slow growing ones, especially in winter. Velvet grass and Tall Fescue contain about half as much Co as most other grasses.

Levels can become depleted in soils which are intensively farmed for a long time, especially under high rainfall and high N, P, K use. But measuring Co in soils is not a good indicator of plant levels because of many interactions; always measure the pasture tissue levels.

If green-growing perennial ryegrass levels are about 0.12 mg/kg (should be 0.13 mg/kg), apply Co sulphate at 500 g per ha (0.5 lb per a) with fertiliser as a carrier. If lower than 0.08 mg/kg, apply up to 1 kg per ha (1 lb per a). Always check pasture levels before applying fertiliser.

In 2007, Dexcel staff on their Scott research farm were injecting cows with vitamin B12. Fertilising

with Co sulphate (21% Co) at 1 kg per ha would have avoided the need for injections and would have grown more clover, which in turn would have produced more natural slow release N. Their farm was very low in clover, as are many in the Waikato through insufficient LimePlus and Co, and too much urea.

Maize on our farm had 0.07 ppm Co. Some USA maize contains half this level. The Department of Botany, Annamalai University in Tamilnadu, India, found that optimum Co levels increased growth, mineral content and the yields of maize by increasing seedling vigour, number of cobs, number of seeds per plant and total chlorophyll contents. An excess of Co has a negative affect on the above.

A New Zealand fertiliser salesman told a GrazingInfo member that Co was not needed by maize for silage, but as with many salesmen, he was wrong. He also said that Co applied with maize would be a waste because maize wouldn't take it up and it would leach. Co doesn't leach under maize in New Zealand summers, simply because little rain goes to below maize root depths, and chisel ploughing to 40 cm allows roots to go deep. See Maize for photos. The ignorance of some fertiliser companies is unbelievable, and unpardonable. They have more influence on farmer buying decisions than anyone. I have to justify my proven recommendations while theirs are accepted blindly, most of which are wrong, because they are influenced by profit from selling potassium at $800/tonne, rather than from successes. Co is $50/tonne, but only 1 kg/ha is applied.

Fertiliser sales people should subscribe to and read GrazingInfo for full honest, unbiased information on fertilisers, which is their business, and on lime which is only $25/tonne. It prevents Facial Eczema, improves soils and makes profit on it cost in the first year. In fairness to their farmer clients, they should know all the above. Soils with optimum calcium levels in the pasture, will increase the soil's organic matter level which holds Co, thus reducing its leaching.

Plant cobalt deficiency symptoms

Clovers, through a lack of producing enough N, will be adversely affected if Co levels are low. Deficient clover leaves can have hard brown edges and their nodules will be small and few.

Soil & plant cobalt excesses

Excess Co is rare, so avoid excess application of Co, but its very high cost of $50/kg, prevents it.

Deliberate soil eatin

Some animals know when they are lacking a mineral and know where to find it. In Ohio, USA, a herd pushed through a fence to eat this subsoil (note the topsoil, uneaten) to overcome Co deficiency. Wild animals also came to the same bank and ate it. However, don't take from this that animals can balance their mineral levels from self-feeding or cafeteria-type mineral supplementing. Many farmers and scientists have tried this system and given up. An example is that most animals need a lot of Mg, but won't eat it because it is so bitter. Lick some Mg oxide and taste it yourself. Mixing it with salt will encourage them to eat it, but if a good soluble mineral mix is supplied in the drinking water, there will be no need for self-help licks, or spreading Mg on pastures.

Deliberate soil eating by deficient animals, or forced overgrazing causing mud to be eaten in wet weather or dust in dry weather, can provide sufficient Co to ruminants in areas where pastures are only marginally low, but not enough where pastures and soil are severely deficient. Changing to correct grazing so that animals don't eat soil, can cause low Co symptoms in animals because pasture has less Co than soil. Fertilising with Co sulphate at between 0.3 and 1 kg per ha fixes the problem in most soils, but might have to be applied annually in sandy and pumice, low-organic soils, that get more than about 600 mm of rain which leaches Co out of low humus soils.

In parts of North America, pasture Co levels are dangerously low. Examples are Virginia 0.01 mg/kg, Hawaii 0.03 and Colorado 0.04, when all should be 0.13 mg/kg. Animals I saw in Idaho were extremely low in Co. Their pot bellies showed bad digestion, and their rough hair, bad hooves and horns were clear deficiency symptoms.

Co in soils

Co levels are naturally low in sandy and pumice soils because they are low in humus, which is the dark

organic part of soils, that holds Co. Soils naturally low in humus can be low in Co as their humus decreases from soils correctly limed. Soils low in organic matter usually have pastures low in Co, causing calves, and lambs to grow slowly and lambs to not 'finish', which is costly for sheep farmers. sentence has already been used.

Deficiency causes include:

- Excessive use of urea.
- Erosion on hillsides which removes topsoils.
- Low calcium levels, because calcium leaves dairy farms at about 800 kg per hectare per annum in milk and is usually not replaced if the pH is above 5.8. This serious fault is often caused by scientists and backed by fertiliser consultants and companies, which is a disgrace because they should all know that high potassium, which is now common in the Waikato and other areas, and/or high sodium, which is natural in some soils and can also occur on the coasts, to increase soil pH. Rephrase last part of sentence
- Prolonged cultivation exposing the soil to sun, burns up organic matter.
- Repeated fertilising with water-soluble, fast-release fertilisers (superphosphate, DAP, MAP, K and/or N.) that increase pasture yields for a while, and after a few years the reduced organic matter causes Co loss in soils to reduce pasture yields even more. This started in eastern Waikato's high producing farms in the late 1980s, then in other intensive New Zealand grazing farms that did not apply enough lime and its synergistic elements.
- Repeated growing of crops that remove the organic matter, especially bulky crops such as maize silage and sugar cane in tropical climates.
- Repeated removal of pasture for hay/and or silage.

Optimum liming based on pasture tissue calcium analyses (not on pH) increases earthworm numbers and soil bacteria, which turn dead vegetation into humus, which holds Co and selenium, so reduces leaching, encourages deeper rooting of pasture and improves soil structure, all of which increase soil and plant Co levels. Fertiliser companies push their products only and many commision earning consultants are to blame for the increasingly low Co and Ca levels on many farms. I've consulted for 500 farmers and only five (1%) had been applying enough lime. See Elements > Calcium for the 50 benefits of lime.

Lime is necessary to help hold Co in soils

Dairy farmer clients, Brendan and Tania Fernyhough of Walton, Waikato (and many others), suffered because their farm had not had enough lime for decades and their Ca ryegrass (they had no clover) level was 0.4% instead of 0.9%. Low Ca symptoms were apparent. They applied 3,000 kg of LimeMag (73% $CaCO_3$ & 7% Mg) per hectare in early spring 2008. In late spring, an analysis showed it still needed more Ca, so another 3,000 kg of LimeMag (97% $CaCO_3$ and 0.175% Mg) was applied on one paddock, which then shot ahead of the other paddocks. After the second 3,000 kg, their ryegrass Co increased from 0.04 to 0.08 ppm despite very little rain (40 mm) having fallen after the second application. The plant manganese level dropped from being toxic to the optimum 40 ppm. The pasture aluminium level dropped to less than 100 ppm, which is where it should be. They then applied 3,000 kg per hectare of LimePlus over the remainder of their farm.

This heifer of Barry Brunton's was grazing on correctly limed pasture and was receiving Solminix soluble minerals including salt. Clearly this animal has sheen and strong tail muscles (see tail height) thanks to adequate minerals, including salt, Co and Se.

This calf below was west of Hamilton on a thousand calf commercial rearer, was well-reared and adequately fed, but then on his poor pasture, it deteriorated rapidly because of lack of lime, boron, Se and, in particular, Co. As a result, it is low in vitamin B12, confirmed by its pot belly and large head. The weak tail shows Se deficiency, and the rough

hair indicates a lack of zinc and sodium. The low mineral levels caused clovers to be small and unproductive, and pasture feed quality to be low. Look at the poor pasture, which was fertilised using results from soil tests only, so the farmer didn't know that he had trace element deficiencies. It is not his fault; it is that of the 'establishment' group who are ignorant about pasture analyses. They, and the overseer developers, are looking into trace elements at last.

Low Co, Se and copper all at the same time will cause slow growth and serious animal health problems, and can increase internal parasite infestation. Worms then get the blame for ill thrift and for drench resistance, while the real reason was trace element deficiencies and calcium deficiency, which is much worse than a single deficiency.

Millions of animals, sheep in particular, have been drenched for internal parasites because they were not thriving or were scouring, when the real cause was mineral deficiencies. Then, when the recommended internal parasite drench rates have not fixed the ill-thrift, drenches have been changed and/or rates increased, causing animals to become resistant to worm drenches. I, and many others, have known this for 40 years, while some vets and AgResearch employees were led by the worm drench companies to buy and recommend more, and use different expensive drenches. See Animal Health > Parasites.

Co is not very well understood, and soil deficiencies are increasing as less lime and more Urea are applied, both of which reduce soil organic matter, which is essential to hold Co in soils. Many farmers around the world have contacted me about young animals 'not growing' which I have traced to low Co levels, which results in low vitamin B12 in ruminants.

Rorison's lime from Aria in Northern King Country, New Zealand, used to be finer and softer than most, so was available for plants more quickly and had more trace elements in small amounts, which help when 3,000 kg of lime per hectare is applied. To work optimally, lime should have its synergistic magnesium, boron and all deficient elements applied. Read Elements > Calcium.

Over the decades, companies and the country have run out of some trace elements - cobalt a few decades ago and elemental sulphur in 2011. Two fertiliser companies kept charging for it, but not adding it. Spraying small amounts of 'lime flour' by helicorter on pastures achieve little (or nothing - see Elements > Calcium), and wasted money on helicopters, because there is not enough Ca in 200 kg per hectare to have any effect on the soil, or increase organic matter to hold Co. Also, 200 kg per hectare by air can cost as much as 2,000 kg of lime per hectare by ground spreading, so there is no comparison in results. More steep land can be covered by driving up and down, rather than reound and round.

Good organic farming practises (not all are good or fully carried out) increase the organic matter content of soils, but most farmers still don't apply enough lime.

Soils in hot, dry climates usually have lower organic matter levels than similar soils in cooler climates, so can have lower Co levels. Soils in grazed pastures in the cooler, virtually drought-free Southland of New Zealand, have 20% more organic matter than in the Waikato.

A university in Holland got me to look at their pastures because their yield was decreasing each year, despite applying an increasing amount of urea - up to one tonne per ha per annum. Digging with a spade showed that their soils had become like sand and their pastures were no longer pastures, but were just grasses. Clovers had not survived the repeated applications of urea under low Co conditions, and their low organic matter soils would have been very low in Co. The university had harvested much of the pasture every year for perhaps a hundred years for stored winter feed, and seldom grazed the area or applied animal manure, which the would spread on cultivated paddocks, or sell, or dump.

Most confinement countries spread the animal manure on fields to be cropped, rather than on pastures where much of the organic matter originated. In New Zealand, 99% goes back on to pastures fresh from the dairy cow, so pastures do well. Storing animal manure, as done under animal confinement, causes losses of N and S into the air, and can also cause human breathing problems.

It is interesting that in Holland, as in USA, dairy farmers do proportionately more grazing than research farms do.

Organic matter and Co can increase in -

• Soils that have adequate LimePlus applied to encourage healthy earthworms, soil microbes and good organic matter levels which will hold Co, Se and some other elements.

• Soils under pastures that are grazed correctly, will increase their humus levels and deepen their topsoil levels.

• Soils that are well managed with controlled grazing and minimum harvesting for silage or hay.

• Soils that have pasture with clovers that cover the soil and produce N.

• Paddocks where silage, hay and any bought feed are fed.

• Paddocks where compost, animal manure or organic matter are spread.

• Irrigated pastures that are grazed, because irrigation keeps more pasture cover on soils, keeping them cooler in hot weather.

• Irrigated pastures grow more pasture that uses more carbon dioxide and feeds more animals that spread more manure.

Environment

Carbon sequestering is written about a lot. It is the removal of carbon dioxide from the atmosphere into plants and roots by photosynthesis which in plants involves the green pigment chlorophyll and generates oxygen as a by-product. This carbon dioxide is absorbed and turned into carbon compounds for plant growth. Carbon is considered sequestered if it ends up in a stable form, such as in wood or soil. Increasing organic matter in soils, as happens under good soil and pasture management, creates an important sink for storing atmospheric carbon dioxide. This could be a profit maker for New Zealand, but excessive use of urea ruins that possibility. Read Elements > Nitrogen.

Humus is often called organic matter because that is how it is measured in some laboratories, but organic matter is the fibrous matter you can see, i.e., dead vegetation and all raw peat. Humus is decomposed organic matter. Peat farmers should not be confused when their peat, although mostly organic matter, is low in humus and so sometimes (not always) has low Co levels in pasture tissue grown on it. Raw peat is mostly un-rotted vegetation, not humus, but it will become humus after chisel ploughing in LimePlus with other necessary elements, and given time to decompose. When grazing pastures on clay or loam soils that get balanced fertilisers, not liquid or fast release fertilisers or fertilisers containing too much artificial nitrogen, Co levels usually remain at the optimum level.

The excessive use of urea hardens soils and acts as a drug, which means once you start applying it you have to keep applying it. Superphosphate is made by mixing sulphuric acid with cheap phosphate to make the phosphate available. Unfortunately it also contains and makes heavy metals like mercury, cadmium, manganese and lead available, so they are absorbed by plants, which are then eaten by animals and humans. Read minerals.

Important discovery

Although Co deficiency was discovered in 1917, it was not until 1937 that topdressing of pastures to increase nutrient levels in poor soils became normal practice. It was at that time the discovery of including minute amounts of Co into fertiliser, eliminated animal Bush Sickness almost overnight.

Prior to 1935, ruminants grazing pastures on pumice soils in New Zealand's central North Island suffered from what was then called "Bush sickness" and died, while horses thrived and multiplied on similar land. In 1935, the problem was traced to Co deficiency and corrected with as little as 1 kg of Co sulphate per ha per annum. It contains 21% Co, but being a sulphate product, it leaches when humus is low. In the past, it has been said that organic matter holds Co, but organic matter as such does not hold anything, it is the humus that holds the nutrients and minerals.

The optimum Co level in correctly fertilised ryegrass in clover based pasture is about 0.13 mg/kg. On correctly fertilised soils, most grasses have about 0.10, but Velvet Grass (Yorkshire Fog) has only about half that. Red and white clovers have about 0.20 mg/kg.

Dairy cattle in confinement in USA are fed two grams of Co sulphate per ton of feed, which is approximately 2 mg/kg in the total ration. Reasonably high levels are not toxic to ruminants, so higher levels in pastures would be an advantage, but are not easy to achieve, so Co should be provided in the soluble mineral mix. If mixed pasture tissue analysis levels of Co are above 0.3 mg/kg, it is usually from

soil pollution with soil during pasture collection. Check the pasture iron level. If it is much over 120 mg/kg, it is usually from soil pollution, so will incorrectly elevate the Co (and manganese) figures. To avoid this, read Pastures > Analysing Pasture Tissue.

Breeding and selecting animals for immunity, resistance, etc., is mostly a good idea, but for some things, such selection is impossible. Low Co is one of these things. A farmer friend agreed that to try to go without Co on sand or pumice (low humus) soils and select thriving ruminants, would be the same as trying to select animals that can go without water - it just can't be done.

Animal blood levels can improve within two days of changing from grazing low to adequate Co level in pastures, but liver levels will take longer to build up. In a trial, Co supplemented lambs had fewer internal parasites and excreted fewer parasite eggs. Co supplementation has also stopped phalaris staggers in sheep (RHM Langer, Pastures 1990).

Alpacas can suffer severely from ryegrass staggers so their pastures should be monitored for Co in ryegrass tests at least twice a year.

Pumice

In about 160 AD, millions of hectares in New Zealand's North Island were covered with light volcanic pumice when Lake Taupo, in the centre of the North Island, erupted. It became the biggest lake in New Zealand. Close to Taupo, the erupted pumice was a metre thick.

Pumice contains air that makes it so light that rain washed it off the hills into the valleys, so the flats ended up with two or more metres of pumice, and the hills ended up as mostly ash type soils. As raw pumice has no fertility at all, the result was that the hills with no pumice left on them, were more fertile, so grew more pasture than the flats, which is the opposite to the norm.

Applying lime with its synergistic elements and fertilising with all deficient elements as shown in analyses of ryegrass, especially Co, since the 1940s, has improved the fertility of the pumice soils unbelievably. They are now highly productive pasturelands, some with more than 30 cm of good topsoil, carrying 2.5 or more healthy cows per hectare without any bought in feed.

Had Co been discovered before planting the North Island's vast central pumice area in mostly Pinus Radiata trees, it would have been sown in clover based pastures as in most of New Zealand. Now some trees are being removed and pastures sown with cobalt at 1 kg/ha.

Sources

Almost all greens, organ meats and milk.

This is certainly a trace mineral in which the hazards should not be treated lightly. It is unwise to take this as a supplement because side effects can occur even at low dosages.

Fertiliser your vegetable garden with 1 kg of cobalt sulphate per hectare, equals 1 kg/1,000 sq metres, which is 1 tenth of a kg per 100 m2 (10 m x 10 m). It costs $50/tonne or $255.00 for 25 kg plus GST.