

MINERAL REQUIREMENTS OF BEEF CATTLE

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INTRODUCTION

Minerals play a key role in the digestion, immune system function reproduction and the development of bones, tissue and teeth of ruminants. Cattle can get these minerals from their feed, their own internal stores in bones and liver, as well as their water supply. Depending on the mineral, issues can be caused by excesses and deficiencies. The focus of this fact sheet will be deficiencies, with caution on toxicities.

We can split the minerals cattle need into two categories. The first of these is macro minerals, that is minerals that are required in large amounts (grams). The second, micro or trace minerals, which are required in small amounts (micrograms). Shown below are the minerals in their categories,

TABLE 1 Minerals required for cattle production

Macro Minerals	Trace Minerals
Calcium (Ca)	Copper (Cu)
Phosphorus (P)	Cobalt (Co)
Magnesium (Mg)	Selenium (Se)
Sodium (Na)	Manganese (Mn)
Potassium (K)	Iron (Fe)
Sulfur (S)	Zinc (Zn)
	Iodine (I)

Mineral deficiencies in stock can have a significant impact on production, including weight and body condition loss and poor growth. This said, it is important to ensure your stock are getting adequate levels of protein, energy, macro minerals and vitamins before investigating trace mineral deficiencies as limiting factors.

The production loss is not always what you can see either. If you're looking at your animal's clinically deficient signs, such as bronzing coats (copper) it is likely that they went through a period of sub-clinical deficiency prior. This period that would have limited their production, as well as decreasing their overall immune system function, increasing their susceptibility to disease.

So, just because Bob next door spreading copper, and your old regional maps tell you your area is deficient, does this mean

you should fertilise too?. Not necessarily. In fact, there is very little evidence that mineral levels in the pasture and soil are directly related.

As for the historical trace mineral maps, as well as what your neighbour says, this should be taken with a grain of salt. Each property will vary when it comes to fertiliser applications, stock classes and rates, therefore it is best to take your investigation a bit further, and with the cost of fertiliser, it's worth getting it right.

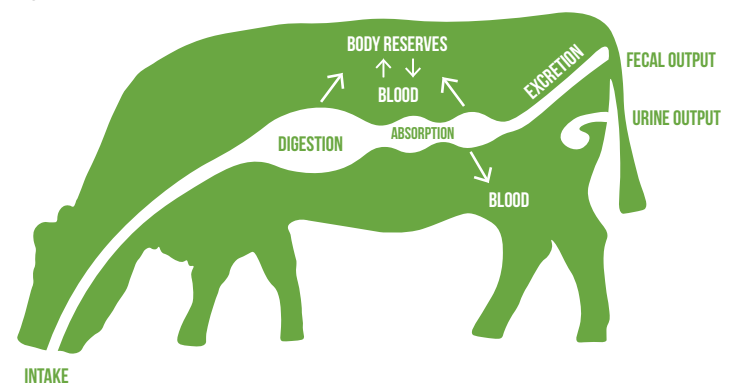


FIGURE 1 Mineral pathways in the the ruminant animal

DIAGNOSIS

So how do you know when your animals have a mineral deficiency?. Broadly speaking, the methods for diagnosis are as follows,

- Blood test
- Liver test
- Faecal test
- Milk test
- Plant tissue test (Feed Test)
- Soil test
- Water test

When diagnosing your animals, it is important to take a look at interacting minerals and their concentrations. Without taking a broad look, even if you do treat your animal's according to that deficiency, a limiting factor to production may still be present.

CASE STUDY

John has tested his animals for calcium and the results indicate a deficiency. He has supplied calcium supplements and the animals have shown little response. Consulting his local vet, it is identified that phosphorus levels are in excess due to recent applications. This excess is limiting the absorption of the supplemented calcium, subsequently inducing the deficiency.

Rapidly growing young animals, along with animals in their first pregnancy, are most susceptible. This is due to their requirements, and the limited time they have had to store minerals in their body.



The key to diagnosing inadequate mineral nutrition comes down to evaluation. This process can be broken down into steps as follows,

1. Other factors, it's easy to get carried away thinking your animal's decreased production is a result of a mineral deficiency. Before heading down that road, try to rule out other factors that may be in play. For example, are they getting enough energy and protein?, is there a worm burden?, is there pestivirus in your herd?

2. Dietary mineral concentrations, are you sure your animals are receiving adequate mineral nutrition?. You've got to measure in order to manage, and it pays to measure through feed and water testing what the animals have access too. Depending on your forage type, forage analysis may cost between \$60 and \$170. Generally, this will also include protein and energy values as well, providing you with more information to make informed decisions on their nutrition. Water testing for minerals will cost between \$\$ to \$\$\$.

3. Herd mineral status, to confirm a deficiency in your herd, contact your local veterinarian to discuss testing for minerals. Broadly speaking, liver samples are the most reliable indicator. The best opportunity to do these sampling is by contacting the abbaitor when you have sent consignments. Testing is discussed further in tables 47565.

Remember, it is important to evaluate animals as a group, don't just single out that one falling behind the rest. Randomly select several animals to evaluate.

METHODS OF SUPPLEMENTATION

1. Free-choice minerals

This method of supplementation is common, with extensive use across Australia. Supplements include licks, mixes and blocks containing trace minerals. Although easy to use, and generally quite affordable, animal intake is highly variable, decreasing overall efficacy. While some animals will consume large amounts, others may only consume little to none. The main attractant in these licks is the molasses and salt, which attracts the animals. The belief that cattle will only consume what they need to correct a deficiency is false, as backed up by extensive scientific literature.

2. In-feed minerals

The incorporation of minerals into the animal's ration is more effective than free-choice, given the animal is more likely to consume its requirements. Care must be taken to ensure that the mineral is included at adequate levels, and is fed accordingly.

3. Drenches

Drenches ensure that each animal receives the dose required. Although this is the case, the labour requirements are generally higher, with animal's requiring regular treatments to be effective. As with other methods of supplementation, ensure that you know your stock's deficiencies and treat for what is required to avoid unnecessary expenses.

TABLE 2 Mineral pathways in the the ruminant animal

Option	Cost \$-\$\$\$	Effectiveness *_*_***	Ease of use *_*_***
Free-choice minerals	\$	*	***
In feed minerals	\$	**	***
Drenches	\$	**	**
Injections	\$\$	***	**
Bolus	\$\$	***	*
Top dressing pasture	\$\$\$	*	**

4. Boluses

Although more expensive than previous methods, boluses provide a longer term treatment and reduce labour requirements in comparison with drenches. Boluses are gelatine or glass capsules containing mineral/s, commonly copper, cobalt and selenium. These are administered orally to the animal and provide a slow release of the minerals.

5. Injection

Injectable minerals are another long-term method for addressing mineral deficiencies of your stock. Administered subcutaneously (under the skin), individual and combinations of injectable minerals are available. As with drenches, be sure that you have identified the deficiencies and avoid unnecessary expenses by only providing what is required.

TABLE 3 Cost of copper supplementation options

Supplementation Option	Cost (\$/hd/year)
Copper Lick Block	\$13.85
Copper Boluses	\$4.29
Mineral Injection (Cu, Mn, Cu, Se)	\$8.01
Copper Injection	\$0.80

6. Top dressing pasture

This method provides a long-term solution to mineral deficiencies. Before applying a fertiliser, ensure that you are providing an adequate amount, and that you have reduced any restricting factors such as alkalinity.

RESPONSE TRIALS

Response trials can be an effective way of measuring your animal's response to trace mineral supplementation. Response to supplementation a good indicator for most nutrients.

Although, to reach meaningful conclusions, the following must be considered in trial design,

- Minimum stock number of 15 head;
- Access to two paddocks with the same history and environment (shelter, access to water, pasture type, fertiliser history);
- Records kept of fat scores, liveweight, stocking rates and descriptions at the start and end of the trial;
- Measurement of pasture quality and quantity throughout the trial of both of the 'paired' paddocks grazed;
- Ability to measure animals at the same time of day throughout the trial to reduce eight differences due to gut fill.

FURTHER READING

Interested in furthering your knowledge on stock mineral nutrition? There are number of resources available including,

Trace Element Deficiency in Cattle, National Animal Disease Information Service

> <http://www.nadis.org.uk/bulletins/trace-element-deficiency-in-cattle.aspx?altTemplate=PDF>

Mineral Deficiencies in Livestock, Victorian Farmers Federation

> http://www.vff.org.au/vff/documents/factsheet_livestock_traceminerals.pdf

Trace Element Supplementation of Beef Cattle and Sheep, Agriculture and Horticulture Development Board Beef & Lamb

> <http://beefandlamb.ahdb.org.uk/wp/wp-content/uploads/2016/03/BRP-plus-Trace-element-supplementation-of-beef-cattle-and-sheep.pdf>

Mineral Deficiencies, Meat & Livestock Australia

> <https://www.mla.com.au/research-and-development/animal-health-welfare-and-biosecurity/diseases/nutritional/mineral-deficiencies/>

Water for Livestock: Interpreting Water Quality Tests, Department of Primary Industries NSW

> http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0018/111348/water-for-livestock-interpreting-water-quality-tests.pdf

Trace Mineral Deficiencies, Agriculture Victoria

> <http://agriculture.vic.gov.au/agriculture/livestock/sheep/sheep-notes-newsletters/sheep-notes-spring-2016/trace-mineral-deficiencies>