

FACTSHEET

Hill Country Futures: Trace element requirements

March 2023

There are well documented deficiencies of certain trace elements in New Zealand, based mostly on soil orders which do not have some of the trace elements in their parent material.

Key messages

- Monitor the trace element status of your own property before supplementing.
- Consult the appropriate professionals for advice.

As its name suggests, a trace element is a chemical element for which living organisms have a very low but essential requirement. Many trace elements are essential to life, albeit in small amounts.

Requirements for animal and plant health

Trace element	Essential for animal health	Essential for plant health
Cobalt (Co)	✓	
Copper (Cu)	✓	✓
Iron (Fe)	✓	✓
Manganese (Mn)	✓	✓
Molybdenum (Mo)	✓	✓
Zinc (Zn)	✓	✓
Boron (B)		✓
Selenium (Se)	✓	
Iodine (I _o)	✓	

Trace elements in New Zealand soils

Selenium (Se)

Animals: Se is required for the immune system, thyroid hormone metabolism and as a protective antioxidant.

Plants: Do not require Se.

Measure of Se levels	Animals: Liver Se levels
Adequate levels	Sheep >450 nmol/kg Cattle >850 nmol/kg
Animal symptoms of Se deficiency	Ill-thrift in all stock types, such as White Muscle Disease and retained placentas.
Susceptibility to deficiency	All soils can be susceptible. Use plant and animal tissue tests to assess.
Supplementation via fertiliser	1 kg/ha sodium selenate (fast release) each autumn
Animal supplementation	Sodium selenate, as a drench, injection or intra-ruminal selenium bullet

Cobalt (Co)

Animals: Rumen microorganisms use Co to synthesise vitamin B12, which is needed by the animal.

Plants: The N-fixing bacteria in clover nodules require Co.

Measure of Co levels	Animals: Liver vitamin B12 levels
Animal symptoms of Co deficiency	Poor lamb growth (ill-thrift). Occurs when liver vitamin B12 levels <110 nmol/kg
Susceptibility to deficiency	Pumice soils, some volcanic ash, and sedimentary soils of the South Island.
Supplementation via fertiliser	If consistently low liver vitamin B12 results, apply: 350 g/ha/yr of cobalt sulphate for 5-10 years followed by 60-100 g/ha/yr as maintenance OR 1200 g/ha/yr of Granular Co for 5-10 years followed by 120-200 g/ha/yr as maintenance
Animal supplementation	If low liver vitamin B12 only occurs in the spring of some years, inject lambs with vitamin B12 every month from weaning

Copper (Cu)

Animals: Cu is a constituent of proteins and involved in blood, bone and nerve synthesis, as well as wool and hair structure.

Plants: Cu is involved in photosynthesis, transpiration and N fixation.

Measure of Cu levels	Animals: Liver Cu levels
Adequate levels	Animals >100 µmol/kg
Deficiency levels	<ul style="list-style-type: none"> Clover growth impacted if Cu <5 ppm Deer and cattle health impacted if Cu <7 ppm in mixed herbage
Susceptibility to deficiency	Animals: <ul style="list-style-type: none"> Cu is most deficient in deer, followed by cattle It is only deficient in sheep grazing on some Pumice and Organic soils
Supplementation via fertiliser	If Cu is persistently low in pasture, apply: Copper sulphate at 5-10 kg/ha initially and 5 kg/ha every 4-5 years N.B. This regime can be ineffective, if pasture Mo is greater than 1 ppm
Animal supplementation	If high pasture Molybdenum (Mo) content, treat animals with Cu injections or copper oxide needles

Molybdenum (Mo)

Animals: Mo is involved in oxygen transfer in body enzymes.

Plants: Legumes need Mo to be able to fix the atmospheric N and then transform that fixed N into a form the host can use.

Adequate levels	White clover (sampled when actively growing) requires: >0.1 ppm Mo and >4.5% N content
Susceptibility to deficiency	Soils: Deficiency is more common on Brown and Pallic soils derived from greywacke
Supplementation via fertiliser	Sodium molybdate at 50-100 g/ha initially and 50 g/ha every 4-5 years OR Granular Mo at 100-200 g/ha initially and 100 g/ha every 4-5 years

Mo availability increases with increasing pH provided the soil parent material contains Mo.. Because Mo interferes with Cu metabolism it is important to remember the influence liming - in addition to a direct Mo application - has on the availability of this trace element.

These images show the impact of Mo deficiency on white clover vigour.



Iodine (I)

Animals: I is essential for the correct functioning of thyroid metabolism.

Plants: Do not require I.

Measure of I levels	Animals: Blood serum I levels
Adequate levels of I	Pasture >0.25 ppm Animals >40 nmol/L in blood serum
Animal symptoms of I deficiency	<ul style="list-style-type: none">• Enlargement of the thyroid gland or goitre• Infertility, reduced wool production and low birth rates
Supplementation via fertiliser	Generally sufficient I is taken up from the soil by plants. Supplementation by fertiliser is not the suggested remedy in cases of low animal levels of I.
Animal supplementation	Direct oral dosing at 4 and 8 weeks prior to birth OR Injection with iodised oil at 6 monthly intervals

Boron (B)

Animals: Do not require B.

Plants: B is essential for carbohydrate metabolism, flowering and pollination.

Adequate levels	B is supplied from nearly all pastoral soils to maintain an adequate clover B content of >14 ppm
Supplementation via fertiliser	If low clover or lucerne B content is measured across at least two sampling times, apply: Sodium borate at 5-10 kg/ha Brassica forage crops, especially bulb brassicas but also kale, should have B applied as a matter of course to prevent B deficiency symptoms like 'brown heart'.

Manganese (Mn)

Animals: Mn is required for the enzyme reactions that regulate carbohydrate metabolism and energy transfer and the synthesis of fatty acids.

Plants: Mn is involved in photosynthesis and plays a metabolic role within cells.

Occurrence	<ul style="list-style-type: none">• Mn deficiency in pasture and animals is rare• It will only occur when soils have been over-limed to a soil pH greater than 6.5
Toxicity symptoms	<ul style="list-style-type: none">• Mn toxicity is rare, but can occur when pasture Mn content is greater than 1200-1500 ppm for adult animals, 400-700 ppm for lambs and calves.• Results in the loss of appetite in animals

Zinc (Zn)

Animals: Zn is required for the prevention and treatment of facial eczema and foot rot.

Plants: Zn is required for the activation of enzymes involved in carbohydrate metabolism.

Occurrence	<ul style="list-style-type: none">• Zn deficiencies in pasture are rare• It will only occur when soils have been over-limed to a soil pH greater than 6.5
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Iron (Fe)

Animals: Fe is essential for the correct functioning of haemoglobin.

Plants: Fe is required for the production of chlorophyll.

Occurrence	<ul style="list-style-type: none">• Fe deficiency in pasture and animals is rare• It will only occur when soils have been over-limed to a soil pH greater than 6.5
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Conclusion

Regular monitoring of pasture and animals is essential for the sound management of trace elements. You should accurately assess a deficiency, before treating it.

Further reading

This factsheet is part of the Hill Country Futures soil and fertiliser series. The full series can be found at www.hillcountryfutures.co.nz/resources/soil-and-fertiliser-series

B+LNZ Factsheet: “Trace element nutrition of sheep”. Download at: www.beeflambnz.com/knowledge-hub/PDF/trace-element-nutrition-sheep.pdf

“Use of trace elements in New Zealand pastoral farming” booklet, produced the Fertiliser Association of New Zealand booklet. Download at: www.fertiliser.org.nz/Site/resources/booklets.aspx

“Fertiliser use on New Zealand sheep and beef farms” booklet, produced the Fertiliser Association of New Zealand booklet. Download at: www.fertiliser.org.nz/Site/resources/booklets.aspx

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