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 (Io) | ✓ | |

## 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<br>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 |

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## 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<br>OR<br>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 |
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| Adequate levels | Animals >100 µmol/kg |
| Deficiency levels | • Clover growth impacted if Cu <5 ppm<br>• Deer and cattle health impacted if Cu <7 ppm in mixed herbage |
| Susceptibility to deficiency | Animals:<br>• Cu is most deficient in deer, followed by cattle<br>• 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<br>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.

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| Adequate levels | White clover (sampled when actively growing) requires:<br>>0.1 ppm Mo and<br>>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<br>OR<br>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<br>Animals >40 nmol/L in blood serum |
| Animal symptoms of I deficiency | • Enlargement of the thyroid gland or goitre<br>• 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<br>OR<br>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.

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| 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<br>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.

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| Occurrence | • Mn deficiency in pasture and animals is rare<br>• It will only occur when soils have been over-limed to a soil pH greater than 6.5 |
| Toxicity symptoms | • 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.<br>• 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.

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| Occurrence | • Zn deficiencies in pasture are rare<br>• It will only occur when soils have been over-limed to a soil pH greater than 6.5 |

## Iron (Fe)

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

Plants: Fe is required for the production of chlorophyll.

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| Occurrence | • Fe deficiency in pasture and animals is rare<br>• It will only occur when soils have been over-limed to a soil pH greater than 6.5 |

## 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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