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Copper (Cu)

Though copper is essential for plants and animals, Cu deficiency is widespread in NZ and is found in sheep, cattle and deer. Cu deficiency is most frequently seen in organic soils (peats), podzols (West Coast forested areas and Northland gumlands), pumice soils, coastal sands, some recent soils derived from greywacke loess and limestone soils.

In any soil with a pH 6.5 or more, Cu availability will be an issue, as it is precipitated out of soil solution at these pH's and essentially unavailable. Cu deficiency can therefore be induced from excessive liming. High soil levels of iron (Fe) and molybdenum (Mo) also suppress Cu availability. On the other hand, when the soil is acidic (< pH 5.5), Cu becomes more soluble and so its availability rises. Copper deficiency occurs most frequently during the spring when pasture growth is rapid, especially in old grass dominated swards.

When soil Cu availability is low, there is often a good response to Cu fertiliser application, particularly from the legumes present in the pasture, as white clover generally has a higher Cu requirement than ryegrass. Lucerne is very sensitive to low Cu levels. In addition to Fe and Mo, Cu deficiency can also be induced by interaction with other elements i.e. overuse of phosphorus and sulphur fertilisers. Because Cu is mainly present in the soil in small organic matter particles, Cu availability is generally enhanced by good soil biological activity and decomposition of organic residues.

Cu toxicity also occurs, especially where soil Mo levels are low. Toxicity can also occur in animals (particularly sheep) if soil Cu levels are unwittingly increased at the same time as stock are receiving copper supplementation.

Cu plays a vital role in animals in protecting tissues from oxidative damage and improving immune functions. Cu containing enzymes are also important in such varied areas as bones, nerves and the pigmentation of hair and wool. Cu also facilitates iron metabolism in the blood. Livestock Cu requirements are often correlated to coat colour i.e. darker haired breeds generally require more Cu. However, animal Cu requirement is also related to the natural diet of the stock e.g. deer naturally eat foliage with high Cu levels and so have a higher Cu requirement when grazing pasture than other livestock. For this reason, it is beneficial for deer farmers to incorporate plants with high Cu levels (plantain, chicory) in the pasture sward. Generally, deer Cu requirements are greater than cattle, which in turn have greater requirements than sheep.

Cu deficiency in animals takes two forms: simple and induced. Simple copper deficiency occurs when the copper level in the diet is lower than that required by the animal for maintenance and production. Induced Cu deficiency occurs when dietary Cu levels are adequate but absorption of Cu is impaired by the interference of other minerals. As in the soil, high levels of molybdenum and sulphur can form insoluble complex salts in the rumen, reducing Cu absorption. When pasture molybdenum levels increase above 1mg/kgDM, the availability of copper drops.

High iron levels in livestock can also significantly reduce the absorption of copper. This is not just the result of eating pasture high in iron but can also be caused by iron in the water supply, or from high soil intakes. The latter is often significant if pasture is dirty or grazed too short. When pasture iron levels exceed 100mg/kgDM, Cu absorption will start to be impacted. Levels above 500mg/kgDM will have a severe effect.