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Molybdenum (Mo)

Most of the important trace elements we have discussed in this series so far have been cations (Fe, Mn, Cu and Zn) whose availability in the soil is linked to the cation exchange capacity (CEC) of the soil. Molybdenum, along with boron and chlorine, is an anion. As such, it's availability in the soil is affected by absorption reactions such as those which also influence the availability of other major anion nutrients such as phosphate, sulphate and nitrate.

Though Mo is an essential nutrient for both plants and animals, plant deficiencies are more commonly found in NZ. Like copper and iron, Mo is an electron carrier in plant enzyme systems and plays an important role in facilitating reactions which are essential to photosynthesis and many other metabolic processes. Mo is perhaps best known for its role in two plant enzymes – nitrogenase and nitrate reductase. Nitrogenase is involved in fixing atmospheric nitrogen, while nitrate reductase is involved in the first stage of converting nitrate N to protein.

Addition of Mo to deficient soils can result in substantial increases in pasture production. In the past, this practise has sometimes been viewed as a more cost effective practise than applying lime. Plants especially benefiting from good Mo levels are: clovers, lucerne, peas, beans, brassicas (broccoli and cauliflower in particular), carrots, parsnips, tomatoes and lettuces. If nitrate is the main nitrogen source i.e. where soils are well-drained and aerated, plant Mo requirements may be a higher.

Soil Mo availability to plants is strongly correlated to pH, with availability increasing rapidly as pH rises. Lifting soil pH where soil Mo levels are good can increase the availability of Mo to around 10 times for each unit of pH increase (e.g. pH 6.0 to 7.0). Mo deficiencies are most common in acid soils, especially with a pH < 5.5. Liming such soils can often improve Mo availability but in some soils Mo levels are so low that no amount of liming will correct the deficiency. In such situations, Mo should be applied with fertilisers. However, caution is always advisable with Mo, particularly in late winter/early spring when Mo levels are often elevated. In some circumstances (high pH or limestone based soils) Mo can accumulate in plants to levels high enough to harm animals grazing such plants. High Mo intake in the presence of adequate sulphur can significantly reduce the absorption of copper and induce a copper deficiency. Conversely, low plant Mo intake can lead to copper toxicity in the grazing animal. Clearly, it is important to establish optimum plant levels: generally these should be in the range 0.5 – 1.0 mg Mo/kg legume dry matter.