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Iron (Fe)

Iron is taken up by plants at a much higher rate than is the case with other trace elements. Though major nutrients like phosphorus and sulphur are often analysed in soil tests and the trace element iron is ignored, it is important to appreciate that iron is essential for plant (many enzymes, chlorophyll formation, nitrogen fixation etc) and animal life (blood, many enzymes).

One of the reasons iron is rarely tested is that iron availability is generally good in NZ soils. Like manganese (discussed last month), the level of available iron in the soil is extremely pH dependent. At very low soil pH levels (and also in waterlogged conditions), iron is reduced from its oxidised Fe^{3+} form – in which it is generally found in dry and alkaline conditions – to its highly soluble and readily available Fe^{2+} form. Conversely, where a soil is well aerated and well drained, with good structure and porosity, iron toxicity is unlikely to be a problem. However, where soil oxygen levels are low, Fe and Mn can often reach levels in the soil solution which are too toxic for plant roots.

High levels of iron can also lead to other problems i.e. it can result in phosphorus lock up and can also cause a copper shortage. When soil iron availability levels are high, plants take up more iron than they require and as a consequence, when animals graze the plants, high levels of iron start to build up in the animal. This can lead to a reduced utilisation of copper, manganese, zinc and other elements. High iron levels in animals are not just the result of eating plants with elevated iron levels; often they are the result of direct ingestion of soil by the animal when grazing, especially if the pasture is dirty or too short - this can be reduced to some extent by not grazing pasture too low and/or having pastures of more even height.

Iron deficiency does occur but usually only in well oxidised, limestone based soils where the soil pH is usually quite high. In such situations, the oxidised Fe^{3+} form of iron is too insoluble to supply the iron requirements of plants growing in such soils. This can be a problem, particularly if crops such as wheat and maize are cultivated on these calcareous soils. In fact, on a world wide scale, iron deficiency is the most frequently occurring trace element deficiency. Fortunately, the percentage of NZ soils derived from limestone is quite low and hence, the main concern here is not with a deficiency but an excess of iron, which, as indicated above, arises when soil pH is low and/or the soil is waterlogged.

Iron deficiency can also be triggered by high levels of other elements, especially other trace elements such as copper and zinc. High levels of phosphorus can also have the same effect. As a general rule, P:Fe should occur in a ratio of less than 30:1 in the leaves of most plants. Where high soil phosphorus levels lead to P:Fe levels higher than this, foliar spraying (including suspension based fertiliser applications) is the best way to rectify iron deficiencies, as these approaches avoid the complications that arise with soil uptake.

In summary, Fe availability in the soil, and thus to plants via their roots, is largely determined by the interaction of soil acidity and aeration. Provided pH > 5.5 and soils are not water logged, Fe availability should not be a problem.