

11 MANGANESE

11.1 Role in citrus production.

Manganese is absorbed as a cation (Mn^{++}) and in the same form transported in plant tissue. Manganese (Mn) is not very mobile in the plant and moves with difficulty from old to new tissue.

The functions of Mn in the plant are biochemically about the same as that of magnesium. It is involved in many complexing reactions of enzymes and oxidation-reduction reactions in the photosynthetic transfer of electrons.

Manganese deficiency

Only under very unusual conditions will a deficiency of Mn being the result of a total lack of manganese in the soil. Manganese deficiency develop due to adverse conditions in the soil like high pH, free lime, or water logging that reduce the concentration of available Mn in the soil.

Deficiency symptoms of manganese appear on normal size leaves as mottles between the veins. The symptoms resemble that of a zinc deficiency but less clear and somewhat diffused. .

When lime is applied the manganese status of the leaves decreases. Therefore if the Mn status was on the lower end of the optimal range before liming, a foliar spray with manganese sulphate or nitrate will help to maintain an optimal status after liming.

Manganese excess

Excess soluble manganese is common in red acid soils. Like with copper and iron it is the roots that are more subjected to damage by excess manganese than the top part of the tree.

Manganese toxicity had been confirmed on lemons which received a number of sprays with manganese based fungicides. The leaf symptoms resemble that of a magnesium deficiency although the yellowing is more intense. The chemicals used contain 16 to 21% Mn, probably in a very available form which is much better utilised than the other

component, 2 to 23% Zn. The chlorotic sections of the leaves contain on average 950mg and the green parts 450mg Mn per kg.

Excess Mn does not limit the absorption of Fe but the utilisation thereof.

Sources of manganese

Manganese sulphate contains 23 to 32% Mn depending on the degree of hydration and is the most common source of manganese. Manganese sulphate is used in foliar applications and as a source of Mn in hydroponics. To reduce the incidence of phytotoxicities not more than 250g manganese sulphate should be applied per 100 litres water. Certain fungicides (Dithane) contain enough Mn to satisfy the nutritional requirement. If such products are used in the pest control program, nutritional sprays with manganese can be omitted.

11.2 Fertilisation with manganese

Soil applications

The requirement for manganese applications is due to the conditions in the soil that reduced the concentration of available Mn. Therefore it makes no sense to apply Mn to the soil under conventional fertilisation and irrigation systems. Chelates of manganese can be use but is normally expensive. Most available chelates are EDTA formulations which is unstable at pH levels where Mn deficiencies are to be treated.

Fertigation with microjets

The same argument applies to this approach and foliar applications are the preferred method to correct Mn deficiencies.

Fertigation with drippers

Manganese as the sulphate or nitrate can successfully be applied through the drippers. If the pH of the nutrient solution is kept between 6,0 and 6,5 chelated formulations are not required.

11.3 Foliar applications

Sprays containing 200g manganese sulphate per 100 litres water are usually successful. Other compounds can also be used, provided its efficiency is comparable to that of

manganese sulphate. Manganese nitrate is also available and can be applied at the same concentration than the sulphate. Foliar sprays with manganese are applied in October but if the Mn status is very low, applications prior to blossom are justified. Manganese sulphate is compatible with zinc nitrate, magnesium nitrate, sodium borate and urea. Manganese nitrate can also be applied as a foliar spray.