

IRON:

Iron is probably the most frequently applied micronutrient.

There are two major reasons for this:

- Iron is required in the greatest quantity of the micronutrients.
- Iron's unique chemistry makes it easily fixed and unavailable in growing media or soil.

Iron is one of the most abundant elements on earth, and it is seldom lacking in any soil. Soilless growing media may have a true deficiency, but even in soilless growing media is often ample iron present from inadvertent sources.

The problem is that at **pH** values of above approximately **4.5** there is barely enough soluble iron in soil to satisfy plant needs regardless of the amount of total iron present. The situation is not as critical in soilless growing media because of the high organic matter content; high organic matter increases iron solubility because it forms more soluble complexes.

Following are several factors that can upset this delicate equilibrium of iron in soil or growing media and induce an iron deficiency (many of these factors can also cause a deficiency of the other heavy metals manganese, copper, and zinc).

1 High pH causes the formation of insoluble iron oxides and hydroxides.

2 High bicarbonate and carbonate in the soil solution interferes with the absorption of the ions by plants. Calcareous soils are naturally high in carbonates. This is in addition to the adverse impact of high pH, which accompanies high carbonates.

3 Excessive lime application: Lime is made from carbonates, hydroxides and oxides of calcium and magnesium. Thus, excessive lime application can cause the pH to increase as well as increase the carbonate content of growing media, both of which can induce an iron deficiency.

4 Gradual increases in growing media pH: Factors that cause growing media pH to increase over time can induce a progression towards iron deficiency. This is mainly due to the use of basic fertilisers, which are fertilisers that contain nitrate as the nitrogen source, or the use of alkaline irrigation water.

5 Excessive phosphate fertilization: Phosphate precipitates iron; thus, over-fertilisation with phosphorus can induce an iron deficiency even under acid pH. This occurs in field-grown palms.

6 Excessive manganese copper or zinc fertilisation. The heavy metals compete with iron for absorption by plants completely iron absorption by plants. Usually this is only prevalent with manganese, with overfertilizations with manganese can induce an iron deficiency

7 Root damage: Anything that causes root damage can exaggerate iron deficiency.

8 Excessive watering: Persistent waterlogged conditions in a ground bed or container interferes with the roots ability to absorb iron and can exaggerate an iron deficiency. Complete waterlogging however can cause an iron toxicity

9 Some species are iron efficient: Which means they can absorb iron from the soil even if the pH is high and the iron is almost insoluble. These plants secrete their own chelates, reducing compounds and / or hydrogen for soil acidification from their roots. These species also never exhibit any iron deficiency. Other plants are iron inefficient, which means they can only absorb iron whether pH is in balance and there is adequate soluble iron in the soil. An example would be acid loving plants such as azaleas

Even though there is usually plenty of ironing the soil and some soilless growing media, iron toxicity can result if the pH gets too low. Overuse of chelated iron can cause a buildup of soluble iron in the soil and cause an iron toxicity. Iron toxicity appears in some bedding plants under these conditions. The symptoms are bronze coloration, brown speckling, or small necrotic spots on leaves of bedding plants such as marigolds and geraniums

Waterlogged conditions can also cause iron toxicity because under anaerobic conditions the more soluble ferrous forms of iron predominant. This is a major problem in rice, not seen as being a problem in horticultural plants such as water lilies, rushes or reeds which are grown under waterlogged conditions.

There are many iron fertilisers on the market. The sulphates and oxides work well if the proper pH balance is maintained. The chelates are excellent if the pH is high or in liquid feed programmes with alkaline irrigation water. There are many other iron fertilisers on the market of variable origins (such as acidified mining residuals extracted or liquefied plant extracts humates of unknown composition) and they should be tested in your production's situation before wide use