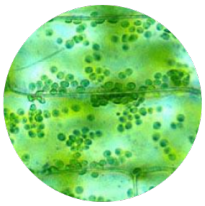
Manganese

Micronutrient Profile

Manganese (Mn) is an essential micronutrient that promotes crop health and production. Plants take up the micronutrient in its Mn^{2+} form. Manganese in sufficient amounts enhances photosynthetic efficiency, dry matter production, and disease resistance, resulting in improved crop yields. However, manganese deficiency is a widespread problem for crops. Let's look a bit more into the function of Mn in plants and the factors that affect its availability.

Manganese's Function in Supporting Plant Growth

Manganese is reported to activate over 35 different enzymes in plants, some of which catalyze different steps of ligninfication and phytoalexin biosynthesis. This essential plant nutrient plays a key role in physiological processes, most notably of which is photosynthesis. For example, Mn facilitates the photolysis of water molecules and provides energy for photosynthesis. Other functions of Mn include:

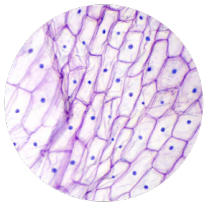


Chloroplast Formation

Nitrogen Metabolism

Photosynthetic Efficiency

Stress Tolerance



Protection from Free Radicals

Factors That Impact Manganese Availability

Manganese is absorbed by plants as a divalent metal cation (Mn^{2+}). Manganese chemistry in soils is complex. The amount of available Mn is primarily influenced by:

- Soil pH – The concentration of available Mn increases 100 times with each unit pH decrease.
- Carbonates – An increased soil pH makes Mn less available.
- Organic Matter – Chelation at high levels reduces available Mn.
- Moisture Content – Temporary waterlogging can cause Mn toxicity.
- Climatic Factors – Mn is less available under warm and dry conditions.
- Interaction with other nutrients – High levels of Cu, Fe or Zn can reduce plant uptake.

Impact of Manganese Deficiency on Crop Yield

Maintaining adequate Mn levels in crops is critical for achieving maximum crop yield and quality. When crops are deficient in Mn, they may experience the following effects:

- Reduced dry matter production and yield
- Weakened structural resistance against pathogens
- A weakened wax layer, which makes crops more vulnerable to drought and heat stress
- The impairment of lignin biosynthesis, which serves as a barrier against root rot diseases

Common Signs of Manganese Deficiency

When concentrations of Mn in plant tissues are below 15-20 ppm, crops will experience deficiency symptoms. Deficiency symptoms are typically first seen in newly formed growth, since Mn is immobile in plants. These symptoms may start with pale, mottled leaves followed by interveinal chlorosis. Other plants may also develop gray or brown spots, but this can also be a sign of Mn toxicity when soil pH drops below 4.5. Citrus is the most sensitive to Mn deficiency.

Citrus

Cucumber

Plum

It is important to note that manganese deficiency symptoms do not present themselves uniformly and can vary from field to field depending on soil conditions. Mn deficiency is difficulty to detect visually, because the same conditions that lead to Mn deficiency also cause Fe and Zn deficiency, which have more prominent visual symptoms. The only way to confirm a Mn deficiency is with a tissue test.

Correcting Manganese Deficiency Through Fertilization

Prior to applying a Mn fertilizer, soil and plant tissue samples should be taken so that the appropriate corrective action can be performed. On soils with high pH and/or organic matter, attempting to build Mn levels is not recommended due to their high Mn fixation capacity. Banding with an acid or acid producing fertilizer has proven to be effective. Manganese sulfate ($MnSO_4 \cdot 3H_2O$) and chelated Mn (MnEDTA) are common Mn fertilizer sources. Foliar application of a quality Mn fertilizer has also proven to be effective on a wide variety of crops.

Our agronomists are available to consult on your fertilizer application needs. Experienced with both applications in conventional and organic soils, they can help you apply the right solution at the right time for optimal crop performance. Contact us.

qualitechco.com | 318 Lake Hazeltine Drive | Chaska, MN 55318-1093 | o. 952.448.5151