



LAQUA

HORIBA



CALCIUM SPOTLIGHT

Calcium (Ca^{2+}) is one of the most crucial macronutrients for tomato plants, influencing structural integrity, nutrient transport, enzyme activation, stress tolerance, and fruit quality. Unlike other mobile nutrients, calcium is immobile within the plant, meaning that a continuous supply is essential for proper growth and development. A deficiency in calcium can lead to severe physiological disorders, reduced fruit quality, and lower yields.

1. Structural Support & Cell Wall Integrity

Calcium is essential for strengthening plant cell walls, forming calcium pectate to provide rigidity and stability. It prevents cell collapse, reducing disorders like blossom-end rot (BER) in tomatoes. Additionally, calcium enhances cell division, root and shoot development, and maintains membrane permeability, ensuring overall plant health and stress resistance. Without calcium, plants become weak, leading to stunted growth, leaf deformation, and fruit defects.

2. Root & Shoot Development

Calcium is essential for root elongation, aiding in nutrient and water uptake. It strengthens vascular tissues, ensuring efficient water and nutrient transport to shoots and fruits. Additionally, calcium supports stronger stems, preventing weak or brittle growth. Since calcium is immobile, deficiencies mainly affect young tissues and new roots.

3. Transport of Nutrients & Water

Calcium regulates water balance and nutrient transport by facilitating xylem flow, preventing wilting and ensuring proper hydration. It also acts as a secondary messenger, helping plants respond to stress. Additionally, calcium interacts with potassium and magnesium to control stomatal function, reducing excessive water loss. Deficiency leads to poor water transport, leaf tip burn, curling, and fruit defects.

4. Disease & Stress Resistance

Calcium enhances plant immunity, improves drought tolerance, and aids in stress recovery, ensuring stable physiological functions. Deficiency increases susceptibility to diseases, reduces stress resistance, and shortens fruit shelf life.

5. Tomato Fruit Development & Quality

Calcium prevents blossom-end rot, strengthens fruit structure, extends shelf life, and enhances quality and market value.



Visual Calcium deficiency symptoms

Calcium deficiency leads to cell death in actively growing tissues due to the inability to retain water and nutrients. Symptoms include distorted growth in root tips, young leaves, and shoots, along with growing point dieback, premature blossom and bud drop, tip burn, blossom-end rot, and golden specks.

Interaction of Calcium with other minerals & the effect of pH

Calcium uptake and availability in tomato plants are influenced by its interactions with other essential nutrients:

Calcium vs. Potassium (K^+) & Magnesium (Mg^{2+})

- Competition for uptake: Excess potassium (K^+) or magnesium (Mg^{2+}) can inhibit calcium absorption, leading to deficiencies.
- Balance is key: Maintaining an appropriate Ca:K:Mg ratio is crucial for optimal nutrient uptake.

Calcium vs. Sodium (Na^+)

- High sodium levels can displace calcium in the soil, reducing its availability.
- Saline soils with excessive Na^+ can lead to calcium leaching, affecting root uptake.

Calcium & Nitrate (NO_3^-)

- Nitrate (NO_3^-) enhances calcium uptake, as both move passively through transpiration.
- In low-nitrate conditions, calcium transport may be restricted, leading to deficiencies in actively growing tissues.

Calcium & Phosphorus (P)

- Excess phosphorus can react with calcium to form calcium phosphate, making both nutrients less available to plants.
- Managing phosphorus levels is crucial to prevent calcium lockout in the soil.



Effect of pH on Calcium Availability

Soil pH plays a crucial role in calcium availability and overall nutrient balance:

- ✓ Optimal pH for Calcium Uptake: 6.0 – 7.0
- ✓ Low pH (Acidic Soil) <5.5:
 - Calcium becomes less available due to increased solubility of competing ions like aluminum (Al^{3+}) and manganese (Mn^{2+}).
 - Acidic conditions can lead to calcium leaching, reducing uptake.
- ✓ High pH (Alkaline Soil) >7.5:
 - Calcium can precipitate as calcium carbonate ($CaCO_3$), making it less available to plants.
 - High pH can also reduce the availability of other nutrients like phosphorus, iron, and zinc.



Maintaining balanced soil pH and monitoring calcium levels with HORIBA LAQUAtwin meters ensures optimal nutrient uptake and plant health. Contact us today to get more information!

