

Did you know that elements found in our soils are important to the health of your crops and fruit trees? Please see below the benefits, deficiencies and toxicity of main elements found in our soils.

<b>Benefits of Nitrogen (N)</b>
An important constituent of <b>chlorophyll</b> , protoplasm, protein and nucleic acids.
Increases the quality of all leafy vegetables and fodders and the protein content of food grains.
Increases growth and development of all living tissues.
<b>Deficiencies</b>
Stunted growth.
Appearance of a light-green to pale-yellow colour on the older leaves, starting from the tips. This followed by death and/or dropping of older leaves depending on the degree of deficiency.
In acute deficiency, flowering is greatly reduced.
Lower protein content.
<b>Toxicity: Usually of NH<sub>4</sub>; blocks uptake of K, Ca and Mg.</b>

<b>Benefits of Phosphorus (P)</b>
A constituent of phosphatides, nucleic acids, proteins, phospholipids, and coenzymes <b>NAD, NADP, ATP.</b>
Constituent of certain amino acids.
Necessary for cell division, a constituents of chromosomes; stimulates root development.
Necessary for meristematic growth; seed and fruit development; stimulates flowering.
<b>Deficiencies</b>
Overall stunted appearance the mature leaves have characteristic dark to blue-green coloration; restricted root development.
In acute deficiency, occasional purpling of leaves and stems, spindle growth.
Delayed maturity and lack of or poor seed and fruit development
<b>Toxicity: Depresses the uptake of Cu, Fe, and Zn.</b>

### Benefits of Potassium (K)

An activator of enzymes involved in photosynthesis and protein and carbohydrate metabolism.

Increases size of grains or seeds and improves the quality of fruits and vegetables.

### Deficiencies

Chlorosis along the leaf margins followed by scorching or browning of tips of older leaves; these symptoms progress inwards.

Slow and stunted growth of plants.

Stalks weak and plants lodge easily.

Shriveled seeds or fruits.

**Toxicity:** Plant Suffers Deficiency In Mg And Ca

### Benefits of Calcium (Ca)

Constituent of cell walls in the form of calcium pectate; necessary for normal cell division (mitosis).

Helps in membrane stability; maintenance of chromosome structure.

Activator of enzymes (phospholipase, arginine kinase, adenosine triphosphates).

Acts as a detoxifying agent by neutralizing organic acids in plants.

### Deficiencies

Calcium deficiencies are not often seen in the field because secondary effects associated with high acidity limit growth.

The young leaves of new plants are affected first. These are often distorted, small and abnormally dark green.

Leaves may be cup-shaped and crinkled; and the terminal buds deteriorate with some breakdown of petioles.

Root growth is markedly impaired; rotting of roots occurs.

Desiccation of growing points (terminal buds) of plants under severe deficiency.

Buds and blossoms shed prematurely.

Stem structure weakened.

**Toxicity:** K and Mg induced deficiency.

## Benefits of Magnesium (Mg)

Constituent of **chlorophyll\*** molecule and therefore essential for Photosynthesis.

An activator of many enzyme systems involve in carbohydrate metabolism, synthesis of nucleic acids, etc.

Promotes uptake and translocation of phosphorus.

Helps in the movements of sugar within plants.

## Deficiencies

Intervinal chlorosis, mainly of older leaves, producing a streak of patchy effect; with acute deficiency the affected tissues may dry up and die.

Leaves usually small, brittle in final stages, and curve upwards at margin.

In some vegetable plants, chlorotic spots between veins, and marbling with tints of orange, red and purple.

Twigs weak and prone to fungus attack, usually premature leaf drop.

**Toxicity:** Does not normally occur.

## Benefits of Chlorine (Cl)

Constituent of many compounds found in fungi and bacteria.

Stimulates the activity of some enzymes and influences carbohydrate metabolism and water holding capacity of plant tissue.

## Deficiencies

Wilting of leaflet tips, chlorosis of leaves and finally bronzing and drying.

**Toxicity:** Induces water stress with premature dropping of leaves.

### Benefits of Sulphur (S)

Constituent of sulphur bearing amino acids

Involves in the metabolic activates of vitamins, biotin, thiamine and coenzyme A.

Aids stabilization of protein structure.

### Deficiencies

Younger leaves turn uniformly yellowish green or chlorotic.

Shoot growth is restricted, flower production often indeterminate.

Stems are stiff, woody and small in diameter.

**Toxicity:** Deficiency of protein synthesis.

### Benefits of Zinc(Zn)

Involves in biosynthesis of indole acetic acid.

Essential component of a variety of metallo-enzymes – carbonic anhydrase, alcohol dehydrogenase, etc.

Plays a role in nucleic acid and protein synthesis.

Assists in the utilization of phosphorus and nitrogen in plants.

### Deficiencies

Deficiency symptoms mostly appear on the 2<sup>nd</sup> or 3<sup>rd</sup> fully mature leaves from the top of plants.

In citrus, irregular interveinal chlorosis; terminal leaves become small and narrowed (little leaf); fruit formation is severely reduced; twigs die back.

**Toxicity:** Reduces leaf expansion and root growth.

### Benefits of Copper(Cu)

Constituent of cytochrome oxidase and component of many enzymes – ascorbic acid oxidase, phenolase, lactase, etc.

Promotes formation of Vitamin A in plants.

### Deficiencies

In corn, yellowing and curling of leaf blades, restricted ear production and poor grain set.

In citrus, dieback of new growth; exanthema pocket of gum between the bark and the wood; the fruit shows brown excrescences.

<b>Toxicity:</b> Poor growth, especially of roots in very strongly acidic soils.
<b>Benefits of Iron(Fe)</b>
Necessary for the synthesis and maintenance of <b>chlorophyll</b> in plants.
Essential component of many enzymes.
Plays an essential role in nucleic acid metabolism- affect RNA metabolism or chloroplast.
<b>Deficiencies</b>
Typical interveinal chlorosis; youngest leaves first affected, points and margins of leaves keeps their green colour longest.
In severe cases, the entire leaf, veins and interveinal areas turn yellow and may eventually become bleached.
<b>Toxicity:</b> Bronzing of leaves with tiny brown spots

<b>Benefits of Manganese (Mn)</b>
A <b>catalyst</b> in several enzymatic and physiological reactions in plants; a constituent of pyruvate carboxylase.
Involves in the plant's respiratory process.
Activates enzymes concerned with the metabolism of nitrogen and synthesis of chlorophyll.
Controls the redox potential in plant cells during the phases of light and darkness.
<b>Deficiencies</b>
Chlorosis between the veins of young leaves, characterized by the appearance of chlorotic and necrotic spots in the interveinal areas.
Greyish areas appear near the base of the younger leaves and become yellowish to yellow orange.
Symptoms of deficiency known in cereals as "gray speck".
<b>Toxicity:</b> Occurs at pH < 5.4. Yellowing of margin of young leaves.

## Benefits of Boron (B)

Affects the activities of certain enzymes.

Ability to complex with various polyhydroxy – compounds.

Increases permeability in membrane and thereby facilitates carbohydrate transport.

Involved in lignin synthesis and other reactions.

Essential for **cell division**.

Associated with the uptake of calcium and its utilization by plants.

Regulates potassium/ calcium ratio in plants.

Essential for protein synthesis.

## Deficiencies

Death of growing plants (shoot tips).

The leaves have a thick texture, sometimes curling and becoming brittle.

Flowers do not form and root growth is stunted.

“Brown heart” in root crops characterized by dark spots on the thickest part of the root or splitting at center.

**Toxicity:** Leaves drop prematurely.

## Benefits of Molybdenum(Mo)

Associated with **nitrogen utilization and nitrogen fixation**.

Constituent of nitrate reductase and nitrogenase.

Required by *Rhizobia* for nitrogen fixation.

## Deficiencies

Chlorotic interveinal mottling of the lower leaves, followed by marginal necrosis and in-folding of the leaves .

In some leafy vegetables, the leaf tissues wither leaving only the midrib and a few small pieces of leaf blade (“ whip tail”).

**Toxicity:** High concentration can be toxic to grazing animals.

## References:

- `FAO #9. Fertilizers and Plant Nutrition Guide, pgs. 7 – 14.
- Mills, H. A. and J. D. Jones1996. Plant Analyses Handbook