

# Orchard Trees – Nutrient Deficiencies

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## Orchard Trees – Nutrient Deficiencies

### Introduction

Like us, all plants require a range of different nutrients to live a healthy life. A lack of one or more of these available in the soil can cause problems for the plant. Deficiencies can show up in similar ways for different species of plants, and, fortunately for us these can be seen in the leaves, making them easier to identify. However, it can often be complicated due to a range of factors. The pH of the soil can affect availability of certain nutrients in the soil and can prevent their uptake in the plant – this might mean that there is no lack of that nutrient in the soil at all, just that the soil chemistry does not allow the plant to use it. To complicate things further, plants may suffer from multiple deficiencies, meaning it can be difficult to diagnose individual problems.

The only way to get an accurate diagnosis is to send leaf samples to specialist labs that test the tissue. Commercial orchards often do this, but it can be expensive for community orchard groups to do the same. The best these groups can aspire to is to become familiar with some of the specific leaf ‘clues’ that different deficiencies (or excesses) throw up and to try to address the issue accordingly by adding the required nutrient.

This serves as a basic guide to some of the common deficiencies that you may see in your fruit trees and includes some of the possible easily accessible and organic soil additions available to remedy them.



### Primary (macro) nutrients - those that are required in larger quantities

#### ➤ Nitrogen (N)

Can be added in manure, compost, urine, comfrey leaves

#### What does it do?

- Necessary for formation of amino acids, the building blocks of proteins
- Directly involved in photosynthesis – aids in production and use of carbohydrates

- Essential for plant cell division, vital for plant growth
- Necessary component of vitamins

#### Nitrogen Deficiency symptoms:

**Shoots** – shorter. Should be 20-30cm in apple tree in peak part of its lifecycle. Twigs are skinny.

**Fruit** – fewer, smaller fruit with more being lost during the ‘June Drop’. Earlier to mature.

**Leaves** – pale green to yellow. Smaller in size. Appears on older leaves (further down the shoot) first because Nitrogen is mobile and moves to new growth. Leaves drop earlier.



Nitrogen deficiency and excess Nitrogen, by Internet Archive Book Images [No restrictions], via Wikimedia Commons.

**Excess Nitrogen symptoms:** More likely for the tree to get Fireblight because it’s growing vigorously when bacteria spreads most readily (warm, wet weather). It also



reduces the tree’s ability to take up other nutrients.

**Shoots** – very long and ‘whippy’

**Fruit** – apples have poor colour and go softer more quickly in storage.

**Leaves** – large and very dark that stay on tree for longer.

#### ➤ Phosphorus (P)

##### What does it do?

Phosphorus is a mineral that helps with growth, particularly with root growth. In an orchard you can use urine, wood ash and seaweed.

- Involved in photosynthesis, respiration, energy storage and transfer, cell division & growth
- Promotes early root formation and growth – hastens maturity
- Improves quality of fruits, vegetables, and grains – vital to seed formation
- Helps plants survive harsh winter conditions
- Makes plants use water more efficiently



Phosphorus deficiency on French marigold, by Julie Day  
<https://www.todayshomeowner.com/problem-with-purple-leaves-caused-by-phosphorus-deficiency/>

### Phosphorus deficiency symptoms:

**Shoots** – stunted.

**Leaves** – fewer and smaller. Plant can photosynthesise but won't be able to use that stored energy well. Leaves end up very dark and sometimes slightly purple.

### ➤ Potassium (K)

You can add it to an orchard via urine, mulching with leaves from mineral accumulators (e.g. comfrey), seaweed and wood ash.

#### What does it do?

- Carbohydrate metabolism and the break down and translocation of starches – it increases photosynthesis
- Important in fruit formation – improves the quality of seeds and fruit
- Essential to protein synthesis
- Makes plants use water more efficiently
- Activates enzymes and controls their reaction rates
- Helps plants survive harsh winter conditions and increases disease resistance

### Potassium deficiency symptoms:

**Leaves** – margins turn yellow and then dark brown – looking scorched. No chlorosis between the veins. It appears on old leaves first as it is mobile. K is mobile in plants and builds up in fruit, so symptoms in leaves becomes worse as fruit ripens.



Potassium deficiency on an apple leaf, by Internet Archive Book Images [No restrictions], via Wikimedia Commons.

**Secondary nutrients – needed in moderate amounts and less likely to hinder plant growth**

### ➤ Calcium (Ca)

#### What does it do?

Used for continuous cell division and formation – essential for root tip growth

Involved in nitrogen metabolism

Reduces plant respiration

Aids translocation of products of photosynthesis from leaves to fruiting organs – increases fruit set



Determines soil pH - stimulates microbial activity

### Deficiency symptoms

**Fruit** - will have bitter pit; brown spots on skin and fruit will taste bitter there.



Calcium deficiency causing bitter pit in 'Lord Wolseley', by McAlpine, D. [Public domain], via Wikimedia Commons



Calcium deficiency, by Internet Archive Book Images [No restrictions], via

### ➤ Magnesium (Mg)

#### What does it do?

- Key element of chlorophyll production
- Improves use and mobility of phosphorus and iron
- Activator and component of many plant enzymes

- Influences earliness and uniformity of maturity

### Deficiency symptoms

**Leaf** - yellowing of tissue along margin and between veins resulting in Christmas tree shape. Happens first on older leaves (mobile). (Compare with manganese deficiency)

**Fruit** - Early fruit drop.



Magnesium deficiency, by Internet Archive Book Images [No restrictions], via Wikimedia Commons.

### ➤ Sulphur (S)

#### What does it do?

- Integral part of amino acids
- Helps develop enzymes and vitamins
- Promotes nodule formation on legumes
- Aids in seed production
- Necessary in chlorophyll formation (though it isn't one of the constituents)



## Deficiency symptoms

Leaf – yellow over whole leaf.

### Micronutrients

These plant food elements are needed in small amounts, but they are just as important to plant development as the others. They work "behind the scene" as activators of many plant functions.

#### ➤ Boron (B)

##### What does it do?

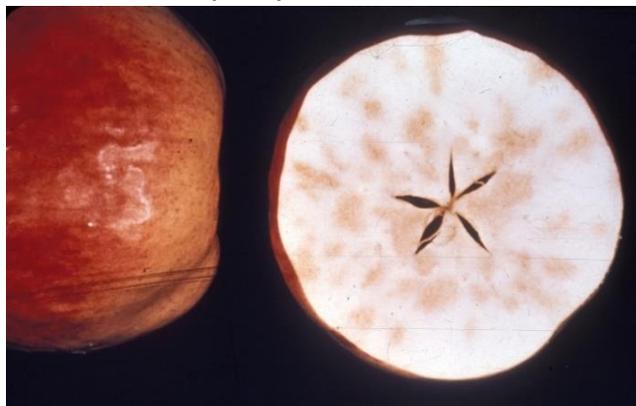
- Essential for germination of pollen grains and growth of pollen tubes
- Essential for seed and cell wall formation
- Promotes maturity
- Necessary for sugar translocation

##### Deficiency symptoms

**Shoot** – severely reduced. Tips may die back. Twigs may go brown beneath the bark as if it has measles.

**Leaf** – smaller.

**Fruit** – fewer fruits. May become deformed and have corky, dry areas within the flesh.



Boron deficiency in Crab apple and Apple, by University of Georgia Plant Pathology. Creative Commons 3.0.



#### ➤ Chlorine (Cl)

##### What does it do?

- Interferes with P uptake
- Supports the transport of nutrients such as calcium, potassium and magnesium within plant.
- Involved in regulating the stomata so important in water regulation.
- Enhances maturity of small grains on some soils

##### Deficiency symptoms

Leaf – chlorosis in patches between veins and not so much the margin.

#### ➤ Copper (Cu)

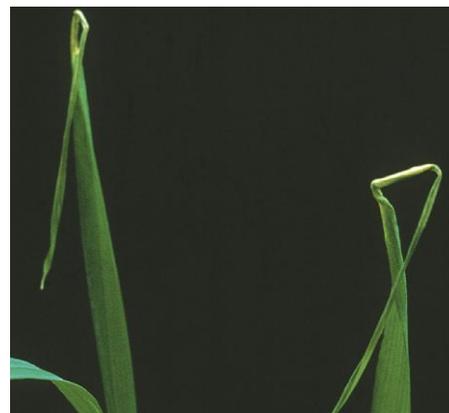
It is the most immobile of the micronutrients. Heavy clay soils are the least likely to be deficient.

##### What does it do?

- Catalyzes several plant processes
- Major function in photosynthesis and chlorophyll production
- Linked to vitamin A production.
- Major function in reproductive stages
- Increases sugar content and intensifies colour

##### Deficiency symptoms

Leaves – go limp and go blue/green, then yellow.



Copper deficiency in wheat by wheatdoctor.cimmyt.org/ Attribution-NonCommercial-ShareAlike 2.0 licence, via Flickr.

## ➤ Iron (Fe)

### What does it do?

- Promotes formation of chlorophyll
- Acts as an oxygen carrier in legume root nodules
- Reactions involving cell division, growth and lignin formation

### Deficiency symptoms

Most likely to happen in alkaline or poorly aerated soils. Inhibited by high levels of phosphorus, manganese and zinc.

**Leaf** – youngest leaves look bleached. Really sharp distinction between green veins and yellow leaf.

**Excess symptoms** - none as such but excess iron reduces zinc uptake



Iron deficiency in Camphor tree *Cinnamomum camphora*, by JonRichfield (Own work) [CC BY-SA 3.0], via Wikimedia Commons.

## ➤ Molybdenum (Mo)

Rarely in short supply. It's more easily absorbed in alkaline soil.



### What does it do?

- Involved in Nitrogen fixation.
- Aids in the formation of legume nodules
- Needed to convert inorganic phosphates to organic forms in the plant

### Deficiency symptoms

Yellowing and stunting of the plant. Leaf margins may look scorched and leaves may roll up.

## ➤ Manganese (Mn)

Very immobile in plants.

### What does it do?

- Functions as a part of certain enzyme systems
- Aids in chlorophyll synthesis
- Increases the availability of P and Ca

### Deficiency symptoms

Most likely to happen in alkaline soils and during dry weather.



Manganese deficiency on apple tree by Department of Primary Industries and Regional Development, Australia  
<https://tinyurl.com/yb3sdmu4>

**Leaf** – yellowing of tissue along margin and between veins resulting in Christmas tree shape. Happens first on younger leaves (compare with magnesium deficiency)

### Excess symptoms

On very acid soil (pH less than 5.5) it may become too readily available. This can cause apple tree bark to crack and break, looking like it has measles. Excess manganese also inhibits the uptake of iron.

### ➤ Zinc (Zn)

Not very mobile in the plant. It's more easily absorbed as soil becomes acidic.

### What does it do?

- Aids plant growth hormones and enzyme system
- Necessary for chlorophyll and carbohydrate production
- Aids in seed formation

### Deficiency symptoms

Shoots – because there is less hormone activity, shoots don't elongate properly resulting in small internodes (the distance between leaves). Also causes 'rosette' of leaves at terminal and some 'blind wood' (lengths of branch with no leaves) on older wood.



Blind wood caused by Zinc deficiency by Mary Concklin, College of Agriculture, Health and Natural Resources, Integrated Pest Management Programme.  
<http://ipm.uconn.edu/documents/raw2/html/374.php?display=print>

**Leaf** – smaller and narrower. Tissue between veins goes yellow, younger leaves being affected first.



Short internodes caused by Zinc deficiency on apple tree by Department of Primary Industries and Regional Development, Australia <https://tinyurl.com/yb3sdmu4>

