

## Signs of nutrient deficiency

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### Healthy plants

A healthy plant is characterised by good size, deep green leaves and good all round development. The plant should look vigorous and healthy at all stages of its development, with evenly coloured green leaves (unless a variegated or patterned variety), strong, sturdy stems, normal sized flowers and fruits in normal abundance.



This information sheet is supported by three video clips found on the last slide of [Analytical services for growers](#)

### Primary nutrients

**Nitrogen** deficiency results in very stunted, spindly yellow plants or yellow leaves, sometimes with pink tints. There is a general yellowing of older leaves (bottom of plant). The rest of the plant is often light green. Visual symptoms are seen first on older leaves as a yellowing (chlorosis) from the leaf tip and along the midrib, whilst the edges remain green. The growth becomes stunted with spindly stalks. Flowers are produced. (Note: in sulfur deficiency yellowing occurs first in the younger leaves).

**Phosphorus** deficiency results in slow growth and dull yellow-green foliage. Plants remain a very poor size. Leaf tips look burnt, followed by older leaves turning a dark green or reddish-purple, eventually developing necrotic tissue (dead patches). Symptoms are seen as reddening of stems, very stunted growth and poor rooting. Flowers are produced, but there are low fruit yields.

**Potassium** deficiency results in very stunted plants with yellow or purple leaf-tints, browning at the leaf edge and poor flowering or fruiting. Older leaves may wilt, look scorched. Interveneal chlorosis (yellowing) begins at the base, scorching inward from leaf margins. Symptoms are first seen on older leaves as a drying of leaf tips and along the leaf margins, followed by death of leaf tissues (necrosis). Poor disease resistance and an increase in the plant's susceptibility to drought, lodging and plant pathogens are also seen.

### Secondary nutrients

**Calcium** deficiency results in distorted or irregularly shaped new leaves (top of plant). The leaf margins and tips become necrotic. Blossom-end rot develops. Growth is only slightly affected at first, but eventually stops as necrotic tissue appears at the growing points.

**Magnesium** deficiency results in yellowing between the leaf veins, sometimes with reddish brown tints and early leaf fall. Not so stunted as major nutrient deficiencies. Older leaves turn yellow at edge, interveneal chlorosis causes green arrowhead shapes or marbling in the centre of the leaf (speckling in cereals). Necrotic tissue develops across the leaves and at the margins. The plant moves its magnesium to growing tissues, so deficiency always appears first in older leaves. This eventually leads to a shedding of leaves, but the plant is able to flower. Magnesium deficiency is common in tomato, apple, grape, raspberry and rose plants.

**Sulfur** deficiency results in younger leaves turning yellow first, sometimes followed by older leaves. Small, stunted plants are produced. This should not be confused with nitrogen deficiency, which appears first on older leaves and then spreads to the whole plant.

## Micronutrients

**Boron** deficiency results in reasonable size being attained, but death of growing points, so flowers and fruits fail to develop. There is rotting and hollowing of roots and leaves become misshapen. Stunted growth and tip dieback occurs on lettuce; brown cracks in celery; rotten swedes, turnips and celeriac, and dimples in pears with brown patches underneath.

**Copper** deficiency results in dark green leaves and stunted plants. Cereals show whitening of young leaf tip with the leaves twisting in spirals and bent over at right angles to the stem. Ears may be malformed and underdeveloped and appear white at harvest; sometimes trapped within the leaf sheath.

**Iron** deficiency results in yellowing between the leaf veins of young leaves. Browning of leaf edges also occurs in acid-loving plants.

**Manganese** deficiency results in dead spots or patches. Yellowing between the leaf veins of young leaves, with browning of leaf edges on acid-loving plants is observed. The pattern is not as distinct as with iron. Palm fronds are stunted and deformed, called "frizzle top." There is a general reduction in size of plant parts (leaves, shoots, fruit). Symptoms typically appear as a speckling and mottled appearance, usually seen on the younger (upper) leaves, which then develop into necrosis.

**Molybdenum** deficiency results in a general yellowing of older leaves (bottom of plant). The rest of the plant is often light green. There are elongated twisted leaves on cauliflowers or other brassicas (cabbage family) growing in alkaline soil. Molybdenum deficiency is normally seen in cauliflowers and brassicas, particularly when growing in insufficiently alkaline soil.

**Zinc** deficiency results in stunted growth and small leaves ('little leaf'). There is general yellowing of older leaves (bottom of plant). The rest of the plant is often light green. Symptoms seen as stunted plants showing a bleaching that can spread to the veins but the midrib and leaf edges remain green. Symptoms appear on older leaves first (unlike sulfur deficiency).

## Finding out

There are many reasons for monitoring germination and the growth of plants:

- Healthy growth means quality crops in good yield. It depends on a sufficient supply of essential nutrients. Nutrient deficiencies can be detected from the appearance of the plant. So the appearance of a plant can indicate insufficient nutrients.
- Nutrient deficiencies are often overcome by using fertilisers. The effectiveness of fertilisers can be determined by monitoring plant growth.
- Plants are indicators of environmental pollution, so monitoring them gives useful information about habitats, ecosystems and environments.

Whether checking on nutrients or on the uptake of other chemical compounds by plants, there are general procedures that can be used or modified for use.

Design a series of experiments to investigate the effect of nutrient deficiencies on plant growth.



**Figure** When designing an experiment to monitor the effect of nutrients on plant growth there are potentially five considerations:

- choice of germinating and growing media;
- choice of containers and conditions;
- choice of seeds and plants;
- observations to be made;
- measurements to be made.