





























Curly, purple or yellowing leaves? Or leaves with brown or yellow spots? These are just a few of deficiency symptoms that growers might encounter. It's cold comfort to know that even the best and most experienced growers have dealt with deficiencies at sometime or another. But we have good news for you and for anyone else who is likely to encounter a nutrient deficiency at least once in their growing career: the CANNA Deficiency Guide is the perfect guide in times of

Calcium, Phosphorus, Nitrogen, Potassium, Manganese, Magnesium and Iron are the primary nutrients that plants need. If you come up against a deficiency in one of the elements in your plant(s), you are in some serious trouble. Brown spots, yellow spots, burned leaves and leaves falling off are just some examples. And if you don't come up with a solution quickly, your beloved plant(s) may pass the point of no return.

The CANNA Deficiency Guide is a great help. It gives you a bit of background information about each nutrient, explains the symptoms, development and reasons for a deficiency, and provides you with a solution at the end. The images really help you to recognize which nutrient deficiency you are dealing with. That said, if you use CANNA products, you will be reducing the risk of a deficiency anyway. That's not only because this range of innovative products has been developed by the highly trained specialists at CANNA Research, but also because CANNA shares its expertise and provides growers with a full package of growing information with the magazine CANNAtalk and the website www.cannagardening.com.

FIRST AID FOR DEFICIENCIES



www.cannagardening.ca

Calcium occurs throughout the entire

plant. It is used for many processes in the plant, however, calcium is most important for the growth process. It has a regulatina effect in the cells and contributes to the stability of the plant. Plants have two ransportation systems at their dis posal: the xylem vessels and the sieve vessels. Most nutrients can be transported via ooth systems, however, for calcium this is not possible. Since calcium can be transported almost exclusively via the xylem vessels, it is an element the deposes of little mobility with in the plant. It is, therefore, im portant that a sufficient amou of calcium is always availab in the root environment, so that it will be continuously

Symptoms of a deficiency

available for absorption

by the plant.

do not close.

The older, larger leaves jus above the bottommost on will show the first symptoms. low/brown spots occur, which are often surrounded by a sharp brown outlined edge. In addition, the growth is curbed and in serious cases the tops are smaller than normal and

Development of a deficiency

The symptoms often appear quickly; milk can be used to increase the pH. Use within one or two weeks of the first spo being visible on the older leaves. The spots usually start as small, light brown specks that increase in size over time.

 After two weeks, the older leaves show ever increasing spots and the spots also often appear at the edge of the leaves, as with a potassium deficiency or with scorch symptoms. The spots have a sharp outline and do not originate exclusively at he edge of the leaves. A lag in development is often already noticeable within a

Sometimes the growing points will wrinkle

up and around the fruits you will find thin. small leaves that are not spotted. • The older leaves die off slowly and yellowish cloudy spots may appear around the necrotic spots. The older the leaf is, the more serious the symptoms

Reasons for a

Culture on calcium fixina

or by excessively high or low

liquid lime fertilisers such as a

calcium nitrate solution. With an

excessively acidic potting mix, lime

relative humidity.

deficiency

 The flowering is also hindered and slowed down. Fruits stay small.

is absorbed in the first quarter of its life. The largest concentrations of phosphorus are found in the developing parts of the plant:

the vascular tissue.

· An excessive amount of ammonium, potassium, maanesium and or sodium in the root environment. The absorption

> is curbed mostly by ammonium and least by sodium Problems with the evaporation caused by ar excessively high EC value

Solutions to a deficiency

• If the EC value of the substrate or the potting mix is too high, it can be easily rinsed out with pure and if necesary acidified water. Additional calcium can be applied through the nutrient solution by means of

• The growth in height, and the development of the plant's side shoots are

the appropriate potting mix that is not too acidic. Acid potting mix often contains insufficient amounts of lime. Good potting mix and Coco substrates are already

For your information: Be careful with fertilisers containing chloride.

key position in the combustion processes of the plant. It is also a "building block" of the cell walls, the DNA, and all sorts of proteins and enzymes. For young plants, the presence of phosphate is indispensable; about 3/4 of the phosphorus consumed during a plant's life cycle

Symptoms of a deficiency

the roots, the growth shoots and

Plants remain rather small with purple/black necrotic leaf parts, which later on become malformed and shrivelled.

Development of a deficiency

ootassium.

 After 2 to 3 weeks, dark purpl black necrotic spots appear on the old and medium-old leaves, making the leaves malformed.

elled, have a typical ochre purple colour

• The plant flowers fully, but the yield will

Phosphorus

Phosphorus plays an important role for all Due to the low concentrations in which living organisms and is an essential nutrient phosphate appears in nature, the affinity of plant cells for phosphorous allows easy absorption through the whole root. There- The growing medium has a too high oH (higher than pH 7). In such cases the plant can not absorb phosphorus due to the fact

that insoluble phosphorous compounds develop. • The ground is too acidic, or too rich in iron and zinc This hinders the absorption of phosphate. • The potting mix has be-

to absorb. Also always mix the phosphate fertiliser THOROUGHLY through the potting mix. · When pH is too high, acidify the medium by using

 At first, the plant becomes dark green - a different sort of dark green (blue, green) as appears when there is a shortage of

The purple/black necroses expand to the leaf's stem. The leaf turns, curls consid-

erably and dies off. The dead leaves are curled and shriv-

About magnesium in short

come fixated. Phosphate car not be absorbed any more.

olutions to a deficiency Always use inorganic phosphates as these are easy his breakdown is visible as rusty brown spots and/

a thinned solution of phosphoric acid. Choose products that have

> percentage on the packag ina instead of alternative

for - amongst others - plants. In plants, it because uptake is inhibited because of epresents a building block for chlorophyll A very wet, cold and/or acidic root (leaf green), and therefore, it is essential or photosynthesis. At the same time • A high quantity of potassium, ammo nagnesium plays an important role i

calcium, it is also a component in drinking water, or clay pottin of tap water, influencina mixes rich in calcium) in con vater hardness. Inorgania parison with the quantity o magnesium. are produced using the A limited root system and same bases that are used

af green in the medium-ol eaves under the flowering top will be broken up. and the magnesium will be transported into the oung parts of the plant.

or vague, cloudy, yellow pots between the veins. A slight

a guaranteed phosphate

hortage of magnesium hardly affects flowering, although th development of the flow-

ers make the deficiency

Development of a

Signs of a deficiency firs

appear around the 4th-6th

eek, Small, rusty brown spot

oduction will be reduced.

nd/or cloudy yellow flecks appear

The colour of the young leaves and the

ymptoms worse.

deficiency

of the plant).

he energy transfer. Together with

nagnesium fertilisers

produce potassium

When there is a shortage, the

Symptoms of a

ertilisers.

deficiency

phosphate-containing products like guano or manure.

Reasons for a deficiency

The magnesium deficiency can occur

nia and/or calcium (for instance high concentrations of calcium carbonate

neavy plant demands.

absorbed by the plant ar lacking. The absorbency · A high EC in the growin of iron is strongly depend medium, which hinders ent on the pH. Ordinarilv. there is sufficient iron evaporation.

About iron in short

Iron is a vital element for plant life. Iron

the overall metabolism of the plant and

is essential for the synthesis of chlorophyll.

In general, iron is poorly absorbed by the

plant. It can only be sufficiently taken

up by the roots in certain forms and

under proper conditions. Potting

mixes seldom contains too lit

tle iron, but it is possible tha

forms of iron that can be

present in absorbable form i

leaves. With a serious iron

shortage, the older leave

and the plant's growth and flowering are

and the smaller veins

in the leaf can also turn

acidic potting mixes.

has a number of important functions in

Solutions to resolve a

Symptoms of a · When a shortage is diagdeficiency nosed, the best thing to do is to spray with a 2% solution of Epsom salts.

 Fertilisation via the roots: growth or high plant norganic: Epsom salts on by a strong yellowing hydroponics or Kieserite (magnesium sulphate mond hydrate). Organic: composte turkey or cow manure.

Recovery

Rectify the possible causes: In potting mixes, when the pH is too low (less than 5 use magnesium contain ing calcium fertilisers. Or hydro, temporarily apply a nutrient solution with a higher pH (6.5). When the EC is too

feed with drinking water only. When the middle-aged leaves (under the top growing indoors, keep the root tempera ture between 20 - 25 degrees Celsius. A little extra magnesium is not particularly harmful. When growing in potting mixes The size and number of rust-brown spots excessive quantities of magnesium do no appear quickly. Too much magnesium inhibits the uptake of calcium, and the In serious cases the leaves show necrosis,

aves are also affected and the flower • stunted growth, and dark-coloured

Iron

 The pH in the root environment is too high (pH> 6,5).

 The root environment contains a lot of zinc and/or managnese The concentration of iron is too low in

the root environment • The root temperature is low. • The root medium is too wet,

> the roots to stagnate. • The root system functions inefficiently due to damaged, infected or dead

causing the oxygen supply in

• There is too much light on the nutrition tank; light promotes the growth of algae Algae also use up the iron and

Iron deficiency can occ during periods of heavy stress and is characteris of the young leaves and the growth shoots betwee the veins. This occurs chiefly because iron is not mobile in th plant. The young leaves can draw any iron from the olde

 Green/yellow chlorosis, from inside to the outside in the younger leaves and in the growth shoots. The veins remain mostly Continued yellowing of the leaves to sometimes almost white. Also, large leaves turn yellow. This inhibits growth.

inhibited.

Reasons for a deficiency

oreak down iron chelates.

Solutions for a deficiency

Lower the pH. • Iron chelates can be added to the substrate. • Drainage can be improved, or the ground temperature can be increased. A leaf nutrient with iron che-

lates can possibly be applied. If a good fertiliser is used with hydroponic growing, an iron deficiency is almost out of

the guestion. The best thing you can do is to spray the plants with a watery solution of

EDDHA. • (max. 0.1 grams per litre) or EDTA chelates (max. 0.5 grams

ellow and finally fall off. evelopment of a deficiency

Stalks will turn purple and leaves will

iddle and top parts of the plant. The plant is a lighter colour as a whole. arger leaves in the lower part of the ant turn light green. The leaf stalks of ne smaller leaves now also turn purple pical vertical purple stripes appear in

• Leaves in the lower part of the plant Nitrogen is one of the important elements

um. It can also be absorbed

ria small oraanic mol-

the balance between

ecules. It is important that

and ammonium is correct

in the feeding otherwise

the pH in the rhizosphere

too high or too low. Plants

with nitrate as their source

organic acid content. This

taste and storage life of

the harvest among other

things. Nitrate is converted

into ammonium in the plant

by the nitroreductase enzyme

Ammonium is then assimilated

organic molecules. Nitrogen

nas a positive influence on

he plant's growth. The

plant gets bigger leaves,

more branches and

Symptoms of a

xtended

deficiency

the vegetative period is

has an influence on the

of nitrogen have a higher

environment immediately sui

ounding the roots) will becom

turn more yellow and then become white. a plant needs. It is an important part of • The growth is visibly inhibited giving shortnd DNA. Because it is a component of er plants, thinner stems, less leaf formation Further yellowing and whitening occurs reactions and plays an active role in the in the top and middle parts of the plant. plant's metabolism. Nitrogen is Leaves on growing points remain absorbed by the plant in the green longer but they are a form of nitrate and ammoni-

Nitrogen

ot less green than at normal itrogen levels. Forced flowering starts ind there is substantial leaf oss. Substantial reduction

correct feeding or giving feed-

ng that contains insufficient deficiency nutrient elements. Substrates Tips of the vounger that contain a lot of fresh leaves show grey edges. rganic material can Leaves turn yellow from cause nitrogen deficiency the edge in the direction because micro-organisms of the veins and rustycolbind the nitrogen. A lot oured dead spots appear in of nitrogen can be bound, the leaves. particularly in the first weeks: this • The tips of the leaves curl up

Symptoms of a

Evaporation is reduced if

there is a shortage of pc

tassium. A consequence

is that the temperature

in the leaves will increase

and the cells will burn. This

evaporation is highest.

Development of a

ultimately fall off.

produces meagre,

flowering.

An extreme short- age

unhealthy-looking plants

with strongly reduced

Solutions for a deficiency

Too little, or the wrong type of

Growing in potassium-fixed potting

An excess of sodium (kitchen salt) in the

oot environment, as sodium slows down

occurs mostly on the edges

of the leaves, where normally

deficiency

s released later but it is generally radically and whole sections of the leaves begin to rot. The leaves keep on curling and

Solutions to resolve a deficiency Raise the EC of the feeding and rinse the substrate well

with it. Add nitrogen yourself to the feeding solution by using urea, blood meal, semi-liquid manure or by using a special "mono-

• Spray the underside of the leaves with a nitrogen solution. This can best be done at the end of the day, just before the lights are turned off. Be careful not to cause

nutrient' product.

Potassium

About potassium in short Solutions for a deficiency It is necessary for all activities having to In case the EC in the substrate or potting

mix is high, you can rinse with water. do with water transport and the opening Add potassium vourself, either in inorcare of the strength and the quality of the ganic form: Dissolve 5 – 10 grams of potassium nitrate in 10 litres of water. In acidic cesses such as the carbohydrate system. potting mixes, you can add potassium

> (5ml in 10 litres of water). Add potassium in organic

 Add a water solution of wood ash, chicken manure or slurry of manure (be careful not to burn the roots). Extracts of the grape family also contain a lot of

For your information Potassium is absorbed auick

bicarbonate or potassium hydroxide

and easily by the plant. In a hydroponic system results aet visible within severa days. Potassium supplementation by leaf fertilisation is not recommended.

 Too much potassium will cause salt damage, calcium and magnesium deficiencies and acidification of the root envi-

ronment! deficiency ne progression in chrono

ogical order: Yellow stripes appear

> eins on the larger leaves he top of the plant. The yellowing between the de veins spreads further over

necrotic spots can form. The final result is a small plant (-10%) with ninimum fruit/flower production.

easons for a deficiency

practice, the most common reason is the he pH in the substrate is too high. Like iron anganese is easily dissolved at a low pH alue in the substrate. If the pH is too low, a isk of excess manganese may occur. At high oH values manganese precipitates into

or iron for example. Silicon

symptoms of a deficiency A manganese deficiency causes

different physiological changes in ne plant due to a decrease in rotein production. Amongst others, this causes less nitrate o be fixed in the plant. vhich can lead to danger ously high levels of nitrate. Additionally, a lot of chemial reactions in plant cells ow down which may result in a build up of organic acids.

Development of a

between the leaf's side

he leaf and small, vellow/brown

manganese oxide (MnO2) which cannot

different enzyme reactions in the plant, for ex ample in water-splitting during photosynthesis, the synthesis of amino acids and proteins and the build up of plant cell membranes nd chloroplasts. Manganese is generally aken up via the roots. Once inside he plant it is difficult to transport but not as difficult as calcium

and molybdenum improve the transport possibilities for nanganese in the plant.

> Using products that contain trace elements (Tracemix) may also help. A

leficiency is noticed, check

course) managnese, CANNA advise

elements. Trace elements car

he end of the day and spray daily with water after spraying o prevent burning.

o use a mix of all needed trace

manganese precipitates into manganese oxide (MnO2 or black manganese) which causes yellow- brown spots on the leaves

When there are high concentre







plant displays general symptoms of an

vegetation.

per litre).

About manganese in short Manganese is an essential trace element for be taken up by the plant which can cause

all plants. Manganese acts as an activator for Solutions to resolve a deficiency Check the medium's pH when the first symptoms are noticed. High pH values mear that there is less manganese available for the

plant. By lowering the pH of the nutritio (pH min (down)) the medium's pt can be lowered to 5.0-5.5. Low substrate temperature can be the cause of reduced anganese absorption. If a

that the substrate temperatu is sufficiently high (20-25 °C) during the day.

nanganese deficiency is usually no a problem on its own. To facilitat manganese transportation in the plant, molybdenum is eeded. Thus, the problem nay well be a molybdenur

deficiency. High levels of phosphorus may also result i a reduced availability of trace elements like zinc, copper and (of

be given to the plant both in the feeding and by spraying the leaves. Spray the plant at

Excess Manganese

Initially, small spots will appear along the mai and side veins of the leaf, following this the spots will spread out from the veins. Excess substrate (<5.0), this can be corrected with pt plus (up). Oxygen deficiency in the root environment can also cause excess manganese A substrate that is too wet can be a cause.