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CANNA has its own internal research facility - CANNA Research. Because the daily work of this department involves cultivating plants, they know all about the difficult problems that can occur and what can be done about them. Of course, they also work on developing new, innovative products to help do this. We have 22 years of growing experience and close coopera tion with other pioneers, and this has resulted in a huge body of knowledge, which actually knows no equal in the world of growing, let alone outside it. This exceptional combination of specialist expertise and enthusiasm has, over the years, led to the development of an outstanding range of products. For CANNA, the research we do is crucially important. After all, our end users depend on it for great results. So we take our time when we are developing new products – an average of two years in fact. During this time, a team of highly trained specialists will explore every aspect of a new product. Standards are extremely important for CANNA, and because we set them so high, we are able to have 100% confidence in our products

FIRST AID FOR DEFICIENCIES

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About calcium in short

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 regulating effect in the cells and contributes to the stability of the plant. Plants have two transportation systems at their dispo sal: the xylem vessels and the sieve vessels. Most nutrients can be transported via both 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

Symptoms of a deficiency

in the root environment, so

that it will be continuously

available for absorption

by the plant.

do not close.

The older, larger leaves jus above the bottommost or will show the first symptoms. Yellow/brown spots occur, which are often surrounde by a sharp brown outline 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; within one or two weeks of the first spot 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 week. 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

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

Reasons for a deficiency

Culture on calcium fixing

An excessive amount of am-

relative humidity.

monium, 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 an excessively high EC value or by excessively high or low

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 liquid lime fertilisers such as a calcium nitrate solution. With an

excessively acidic potting mix, lime milk can be used to increase the pH. Use the appropriate potting mix that is not too acidic. Acid potting mix often contains insufficient amounts of lime.

For your information: Be careful with

Phosphorus

phosphorus are found in the

the vascular tissue.

Symptoms of a

developing parts of the plant:

the roots, the growth shoots and

key position in the combustion processes of the cell, and in the total energy transfer 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 is absorbed in the first quarter of its life. The largest concentrations of

olutions to a deficiencv

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

Development of a deficiency

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

there is a shortage of ootassium. • The growth in height, and the development of the plant's side shoots are

onsiderably and dies off.

• The dead leaves are curled and shri-

velled, have a typical ochre purple colour.

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

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

Good potting mix and Coco substrates

The plant flowers fully, but the yield will

About maanesium in short

he energy transfer. Together with

calcium, it is also a component

of tap water, influencina

vater hardness. Inorganic

nagnesium fertilisers

are produced using the

same bases that are used

When there is a shortage, the

o produce potassium

Symptoms of a

ertilisers.

deficiency

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. Therefore, shortages do not happen very often, 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 become fixated. Phosphate car

not be absorbed any more.

Always use inorganic

potting mix.

manure.

phosphates as these are

easy to absorb. Also always

mix the phosphate fertiliser

THOROUGHLY through the

When pH is too high, acidify

phosphate-containing

products like guano or

eaf green in the medium-ole leaves under the flowering top will be broken up. and the magnesium will be transported into the oung parts of the plant. his breakdown is visible s rusty brown spots and/or rague, cloudy, yellow spots between the veins. A slight short age of magnesium hardly affects owering, although the

the medium by using a thinned solution of phosphoric acid. Choose products that have a guaranteed phosphate development of the flowpercentage on the packaers make the deficiency ging instead of alternative

Development of a deficiency

ymptoms worse.

Signs of a deficiency first appear around the 4th-6th reek, Small, rusty brown spots nd/or cloudy yellow flecks appear the middle-aged leaves (under the top growing indoors, keep the root temperaf the plant).

n the leaves increase. The symptoms spread out over the plant displays general symptoms of an excess of salts; aves are also affected and the flower • stunted growth, and dark-coloured oduction will be reduced.

Reasons for a deficiency

Magnesium is an indispensable element The magnesium deficiency can occur 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, ammonia and/or calcium (for instance high nagnesium plays an important role i

> concentrations of calcium carbonate in drinking water, or clay potting mixes rich in calcium) in con parison with the quantity o magnesium. A limited root system and

> > neavy plant demands. A high EC in the growing medium, which hinders evaporation.

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:

norganic: Epsom salts on 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. On hydro, temporarily apply a nutrient solution with a higher pH (6.5). When the EC is too

high, rinse and/or temporarily feed with drinking water only. When ture between 20 - 25 degrees Celsius. The colour of the young leaves and the 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 not appear quickly. Too much magnesium inhibits the uptake of calcium, and the

Iron

Nitrogen

reactions and plays an active role in the

plant's metabolism.

Nitrogen is mainly absorbed

by the plant in the form of

can also be absorbed via

small organic molecules.

oalance between nitrate

and ammonium is correct

in the feeding otherwise

the pH in the rhizosphere

environment immediately sui

ounding the roots) will becom

too high or too low. Plants

with nitrate as their source

of nitrogen have a higher

organic acid content. This

has an influence on the

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

has a positive influence on

the plant's growth.

The plant gets bigger

leaves, more branches

and the vegetative pe-

iod is extended.

symptoms of a

t is important that the

nitrate and ammonium. It

high (pH> 6,5). zinc and/or managnese

the root environment

mixes seldom contains too lit causing the oxygen supply in tle iron, but it is possible tha the roots to stagnate. forms of iron that can be absorbed by the plant ar lacking. The absorbency of iron is strongly depen-

> on the nutrition tank; light promotes the growth of algae Algae also use up the iron and break down iron chelates.

Iron deficiency can occi during periods of heavy growth or high plant stress and is characteris by a strong yellowing of the young leaves and the growth shoots betwee the veins. This occurs chiefly because iron is not mobile in the plant. The young leaves can' draw any iron from the olde leaves. With a serious iron shortage, the older leave

and the smaller veins in the leaf can also turr

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

dent on the pH. Ordinar

ly, there is sufficient iron

acidic potting mixes.

present in absorbable form i

has a number of important functions in

 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. In serious cases the leaves show necrosis, and the plant's growth and flowering are inhibited.

Reasons for a deficiency

The pH in the root environment is too

The concentration of iron is too low in

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

> • The root system functions inefficiently due to damaged, infected or dead

• There is too much light

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 chelates 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 per litre).

deficiency Stalks will turn purple and leaves

rill yellow and finally fall off.

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

About nitrogen in short Leaves in the lower part of the plant

turn more yellow and then become Nitrogen is one of the important elements white. Finally, the leaves whither and a plant needs. It is an important part of proteins, chlorophyll, vitamins, hormones and DNA. Because it is a component of The growth is visibly inhibited giving shorter plants, thinner stems, less leaf enzymes, nitroaen is involved in all enzyme

> formation and smaller leaves. · Further yellowing and whitening occurs in the top and middle parts of the plant.

> > • Leaves on growing points remain green longer but they are a lot less green than at normal nitroaen Forced flowering starts

and there is substantial leaf loss. Substantial reduction in

Reasons for a deficiency

Development of a

Deficiency can be caused by deficiency incorrect feeding or giving Tips of the vounger feeding that contains insuf leaves show grey edges. ficient nutrient elements. Leaves turn yellow from Substrates that contain a the edge in the direction lot of fresh organic material of the veins and rustvcan cause nitrogen deficoloured dead spots ciency because microappear in the leaves. organisms bind the nitrogen. • The tips of the leaves curl up A lot of nitrogen can be bound, radically and whole sections of particularly in the first weeks; the leaves begin to rot. The this is released later but it is leaves keep on curling and

ultimately fall off.

· An extreme short-

age produces meagre

unhealthy-looking plants

with strongly reduced

Reasons 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

Symptoms of a

Evaporation is reduced if

there is a shortage of po

tassium. A consequence

is that the temperature

in the leaves will increase

and the cells will burn. This

evaporation is highest.

occurs mostly on the edges

of the leaves, where normally

deficiency

Solutions to resolve a

deficiency Raise the EC of the feeding and rinse the substrate well with it.

feeding solution by using urea, blood meal, semi-liquid manure or by using a special "mono-nutrient' product. 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

Add nitrogen yourself to the

generally too late.

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

Potassium

do with water transport and the opening mix is high, you can rinse with water. 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 bicarbonate or potassium hydroxide

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 auickly

and acidification of the root envi-

ronment!

(5ml in 10 litres of water).

and easily by the plant. In a hydroponic system results aet visible within several o be fixed in the plant, days. Potassium supplevhich can lead to danger mentation by leaf fertilisaously high levels of nitrate. tion is not recommended. Additionally, a lot of chemi- Too much potassium will cause salt damage, calcium and magnesium deficiencies

he progression in chronopaical order: Yellow stripes appear between the leaf's side eins on the larger leaves o

The yellowing between the ide veins spreads further over the

easons for a deficiency

About manganese in short

all plants. Manganese acts as an activator for

he transport possibilities for nanganese in the plant.

ciency A manganese deficiency causes dif-

erent physiological changes in he plant due to a decrease in protein production Amonast others, this causes less nitrate al reactions in plant cells slow down which may result in a build up of organic acids.

to prevent burning.

ninimum fruit/flower production.

Manganese is generally taken up

plant it is difficult to transport but not as difficult as calcium or iron for example. Silicon and molybdenum improve

Symptoms of a defi-

Development of a

he top of the plant.

The final result is a small plant (-10%) with

manganese oxide (MnO2) which cannot Manganese is an essential trace element for be taken up by the plant which can cause

that there is less manganese available for the plant. By lowering the pH of the nutritio

eaf and small, yellow/brown necrotic spots

practice, the most common reason is that he pH in the substrate is too high. Like iron. nanganese is easily dissolved at a low pH value in the substrate. If the pH is too low, a risk of excess manganese may occur. At nigh pH values manganese precipitates into

(pH min (down)) the medium's pt

Low substrate temperature

anganese absorption. If a

can be lowered to 5.0-5.5.

Solutions to resolve a deficiency Check the medium's pH when the first symptoms are noticed. High pH values mean

leficiency is noticed, check that the substrate temperatu is sufficiently high (20-25 °C) during the day. Using products that contain trace

elements (Tracemix) may also help. A nanganese deficiency is usually no a problem on its own. To facilitat manganese transportation in the plant, molybdenum is needed. Thus, the problem may well be a molybdenun

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

to use a mix of all needed trace

elements. Trace elements car

be given to the plant both in the feeding and by spraying the leaves. Spray the plant a the end of the day and spra daily with water after sprayir

manganese precipitates into manganese

oxide (MnO2 or black manganese) which

When there are high concentro

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













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 and chloroplasts.

via the roots. Once inside the

can be the cause of reduced

Excess Manganese!

causes yellow-brown spots on the leaves