

Balance can be restored at night

## Many physiogene problems due to poor calcium distribution

**Dry, brown areas (blossom end rot) on tomatoes and peppers; tipburn on lettuce and Chinese cabbage; dry edges on the young leaves and flower leaves of poinsettias; malformed spathe leaves on anthurium. Many such physiogene deviations are related to calcium. They aren't always caused by a deficiency but can be due to poor calcium distribution in the plant. Many sorts of circumstances influence the dispersal of calcium.**

At first glance it might look like a disease or a deficiency but that might not be so. The generic term for such symptoms is physiogene abnormality: the symptoms occur

because something upsets the physiology of the plant. Some examples are blossom end rot, glossiness, tipburn, internal browning and necrosis of the edges of young unfolding leaves or necrosis of whole young leaves in the plant top.

### Poor calcium distribution

In all cases the plant is out of balance. These physiogene abnormalities can be the result of environmental factors such as greenhouse climate, EC, light, CO<sub>2</sub> or drought stress. But some can come from the plant itself, for example if the burden on the plant is too high or too low.

A striking number of such defects are the

result of poor calcium distribution in the plant. This is noticeable across an entire range of crops from fruiting and leafy vegetable crops to cut flowers and pot plants. Fertilising with calcium won't solve the problem, although, of course, that has to be correct.

### Problems occur in the fruit

The problems are caused by the special nature of calcium. This element moves almost entirely with the water flow and therefore mostly ends up where the most transpiration takes place. Hardly any redistribution of calcium occurs: it is not redirected via the phloem from the plant parts that lose the most water. This means that hardly any calcium problems occur in the plant parts that transpire. The problems occur in the fruits, young leaves, edges of leaves and certain flower structures.

### Undesirable reactions

In addition, calcium has a strange property. Sufficient is necessary to ensure that the calcium concentration within the cell remains low. In fact, the concentration of calcium outside the cell is a thousand times higher than on the inside. This difference has to be maintained otherwise complications arise. The cell membrane plays a vital role and calcium is responsible for this too.

If too little calcium is present outside the cell the membrane starts to leak. Then substances can flow into the cell. Also, the vacuole in the cell starts to leak. Substances that are normally separated come together and all kinds of undesirable reactions take place. The places where this happens usually turn brown, such as blossom end rot in tomatoes and peppers, or tipburn in many sorts of flower leaves. Such areas are not brown because of rot. Indeed if you touch them they feel dry. The brown colour is caused by oxidative processes.

### Brown areas

Another characteristic of calcium is that, in small amounts, it plays a similar role to a plant hormone. A hormone is a messenger in a plant. The message sent via this hormone



*Due to insufficient calcium outside the membrane it starts to leak. Consequently, substances enter the cell that normally are separated. Then all sorts of undesired reactions take place, such as blossom end rot in tomatoes.*

(under particular circumstances) is, break down the cell.” This reaction causes the brown spots.

Such a reaction needs to be prevented because once it’s occurred the fruit, plant or flower is worthless. You can throw it away. Incidentally, calcium can be the cause of some problems which aren’t even visible such as poor shelf life, lack of firmness, low vitamin-C level and storage rot – all seen in fruits.

### Screen when radiation is high

All circumstances that lead to a lot of transpiration can lead to the problems mentioned. Also, fast growth of the vulnerable parts increases the risk of abnormalities. The rule of thumb is maintaining a good balance between the increase in the dry weigh and the calcium supply to the tender parts.

For this reason it’s useful to screen when the radiation is high. It can reduce the number of kilos of fruit vegetables but it reduces the risk of blossom end rot. It is also recommended to reduce transpiration by ornamental plants when there is a risk that the leaf tips will dry off.

With fruiting vegetables, in particular, peppers, the method of picking is crucial. Too few fruits on the plant increase the risk of a problem. These few fruits grow very fast and the calcium supply can’t keep up.

On the other hand you often see that a lot of transpiration during the day doesn’t cause any problems. That’s because during the night or early morning the plant builds up enough root pressure. This pushes the water flow, via the xylem vessels, to the parts



*Insufficient calcium can cause cells to leak. In this way substances are brought together and react in an undesirable way causing dry brown edges. The brown colour is the result of oxidative reactions. Photo: Robert Eddy, Purdue University, USA*

where there is little transpiration so they do receive sufficient calcium.

### High root temperature

A grower can manipulate the build up of root pressure during the night. Roots that are too cold don’t build up much pressure. a higher root temperature is better. Also, slowing down transpiration at night can be a good idea, for example by lowering the air temperature. High leaf temperature at night

combined with an open window leads to a great deal of transpiration and therefore little calcium reaches the parts that don’t transpire.

The EC is also important. A high value can cause a physiogene problem, but it makes a difference when the value is high. In trials, an EC of 9 during the day and an EC of 1 mS/cm at night caused considerable blossom end rot in tomatoes. The other way round (an EC of 1 during the day and an EC of 9 mS/cm at night) hardly caused any problems. By comparison, a constant EC of 5 both day and night resulted in less fresh weight and slightly more blossom end rot.

In addition to all of this, the uptake of calcium has to be optimal. If there’s too little, there’s not enough to share and problems will arise even sooner. Factors that slow down the uptake include a high EC and a high ratio of potassium, magnesium and ammonium to calcium.



*Not enough fruits on a pepper plant can increase the chance of problems. These fruits grow too fast and the calcium supply can’t keep up leading to blossom end rot.*

### Summary

Physiogene abnormalities are caused by an imbalance in the plant and not through a disease or deficiency. A striking number of such defects in vegetables and ornamentals are related to calcium. The cause lies in calcium’s special properties. Most problems arise when transpiration is high. Building up root pressure at night can be a solution.