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Silicon strengthens the plants' own natural defences. They manufacture more substances that are toxic to fungi. In research the sensitivity of saintpaulia to powdery mildew was substantially reduced. The effect varied by variety from 35 to 80 per cent.

Silicon, not essential but useful

Adding silicon to nutrient solution is worth considering

Silicon is a mysterious element. It's not essential for plant growth but sometimes plants absorb more of this than other elements. Slowly we are gaining more knowledge about its positive effects: Increased resistance to diseases and higher production. But much is still unknown.

About one quarter of the earth's crust consists of silicon compounds. It's found in sand, clay, quartz and granite. Plants that grow in the ground take up silicon to a greater or lesser degree. But it is not considered to be an essential element; these are elements that the plant needs in order to survive.

Stronger plants

No plant can survive without nitrogen, potassium or magnesium but it can without silicon. This is also the reason that silicon can be omitted from the standard nutrient solution. Therefore greenhouse plants differ in an important way to plants in the ground: They contain very little silicon. This can rightfully be called an unnatural situation.

The question then is whether this is a problem. In the meantime we have a whole mountain of international research showing that silicon in many cases can have a positive influence on production, disease resistance, transpiration and nutrient toxicity. However, the picture per plant species is different and the scientific knowledge is limited.

For example, it's not clear why production goes up and why disease resistance improves when silicon is administered. Some plants – rice is a very well known example – hoard silicon and literally become harder from it. It accumulates in an amorphous form on cell walls, between cell layers, in cavities and often as a layer between the epidermis (the outer layer of cells) and the cuticle. Such hard layers form a physical barrier against fungal hyphae and perhaps against sucking insects. But another mechanism is also at work. Silicon strengthens the plants' own natural defences. They manufacture more substances that are toxic to fungi. How does it work? Who knows may say!

Less transpiration

The same uncertainty also applies to the role of silicon in preventing manganese toxicity. This occurs, for example, in lettuce and is apparent when brown spots appear on the older leaves. Supplementing with silicon during trials did relieve this problem. It didn't influence the uptake of manganese but it ensured an even distribution within the plant. The manganese no longer accumulated in certain places that lead to the brown, dead spots. A similar effect has been found with

other nutrients, such as a better balance between zinc and phosphate. But here too it's unclear how this works.

Chinese researchers discovered that administrating silicon to corn reduced transpiration through the stomata. That means less evaporation per unit of product. From an energy saving point of view this information is also very interesting for greenhouse horticulture, even though still nothing is known about this effect on protected crops.

Better production

Better production after supplementing with silicon is due to a combination of factors. A better balance of minerals or fewer diseases result in a healthier plant and therefore more production. But trials have also discovered higher chlorophyll production, heavier leaves, better leaf position or larger amounts of the CO_2-binding enzyme Rubisco.

All these scientific research results provide plenty of reason to study the favourable effects of silicon on greenhouse plants. The former research station for floriculture and greenhouse crops in Naaldwijk, the Netherlands, carried out such studies on a number of plants in the 1990s. Also its successor PPO has been working on this.

It was quite difficult. Many silicon compounds were not easily taken up or they clogged the water supply system. In the end potassium metasilicate was the most appropriate 'fertiliser'.

The sensitivity of saintpaulia to powdery mildew was substantially reduced. The effect varied by variety from 35 to 80 per cent. However, the sensitivity to Botrytis was not affected by the administration of silicon.

Trial results

The effects were positive on cucumbers. Production increased by about 10% and the mildew infestation decreased. However, the results during commercial trials were less striking although a production increase of 2 - 5% was always achieved. In addition, fungicide usage can be reduced by 15% when silicon is administered. It is still not clear what caused the big difference between the experimental and the practical trial.

An important drawback of the silicon uptake was the emergence of the so-called dew layer on the fruits which meant it was easy to leave finger prints on the fruits during harvesting.

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Courgette and rose also responded positively to silicon under research conditions. Courgette production rose by 10%. Strawberries suffered a considerably milder attack of powdery mildew but there was a negative impact on fruit quality. During a commercial trial with roses production did increase slightly.

The research station was also able to confirm foreign experiences that silicon can reduce toxicity caused by manganese. Supplementing lettuce with silicon resulted in far fewer brown spots. Incidentally it was striking that the silicon level in the treated plants was just slightly higher than in the untreated plants.

Too little known about effect

From all the international research that has taken place it is clear that supplementary silicon can have a positive effect on disease resistance and growth. Manufacturers of so-called plant enhancers are jumping in and offering all sorts of products while, in general, there is nothing to confirm that each product actually helps.

There is a huge difference between plant types and varieties in terms of uptake and effect. Many plants such as tomato, pepper, gerbera, carnation (and also notably: lettuce) take up very little. Cucumber, rose, melon, courgette, strawberry, aster and bean do experience a rise in the silicon concentration when it is added to the nutrient solution.

The problem with many of the studies is that it is carried out on a small scale and not in practical situations. It is also unclear why the sometimes spectacular results in research situations aren't so obvious in practice.

Everything considered, just one conclusion is possible. We still have too little knowledge about the role of silicon in the plant. If horticulture is to benefit from such knowledge a lot of research is still needed. Until then the information that has been acquired so far can be applied although, of course, the cost aspect will also play a role.

From all the international research it is clear that supplementary silicon can have a positive effect on disease resistance.

Summary

Silicon is an unusual element. It is not essential for the plant but it can have a positive effect on disease resistance, production, transpiration and toxicity by, for example, manganese. Research at the former Dutch research station showed that supplementary silicon had positive effects on saintpaulia, rose, cucumber, courgette and lettuce. On the other hand there are many plants that show no benefit from additional silicon. Still too little is known about this element to be able to provide any definite advice.