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Images: Studio G.J. Vlekke

One of few broad-spectrum plant boosters

Need for resilient crop stimulates interest in silicon

Silicon is a proven fertiliser that has produced good results in various crops. Many growers also use it to solve root problems.

The use of silicon fertilisers is clearly on the rise. Silicon can strengthen the resilience of the crop, and with an ever declining range of products available to growers, that's very welcome. Insights are as yet limited and experiences vary, but kalanchoe grower Jan van Luijk is very pleased with the results.

All horticultural suppliers are seeing the trend: sales of silicon fertilisers are growing. And there is a clear reason for this. "More and more growers are keen to make their crops more resilient," says Willem Verkade of Horticoop, suppliers of Actisil and Silika. "Our customers have often heard about silicon and word is getting around. If someone has had good results with it, for example in kalanchoe cultivation, they share their experiences in study groups, spreading the word in the process. But growers still have a lot to learn about it. Some people use too low a dose, for example."

Dose separately

Bram Noordam of Yara, suppliers of Sikal and YaraVita Actisil, can tell that silicon is a hot topic at the moment by the increasing number of queries he is receiving. "I get questions about the method of application and the doses, for example," he says. "They usually come from people who have already formed an opinion on plant resilience. They often already know that silicon needs careful handling. Sometimes it is difficult to dissolve, but provided you apply it properly it is easily absorbed. In Sikal we keep it dissolved in an alkaline environment (high pH). You can't just chuck it into the A or B tank; you have to dose it separately and then add extra acid."

Eric Watzeels of Van Iperen, manufacturers and suppliers of potassium metasilicate and Siliforce, adds: "With so few products available nowadays, growers are on a quest for a more resilient crop, and they are trying to achieve that with the right fertilisers or plant boosters. But there is still a great deal of uncertainty around this subject. There are probably a thousand products that could give plants a boost. And that makes things very difficult, not just for growers but for suppliers too: it's hard to know what works and what doesn't. But silicon is a proven fertiliser that has produced good results in various crops."

Variable effects

Silicon has been used in cucumber and rose cultivation for some time, but growers of sweet pepper, tomato, kalanchoe, gerbera, strawberry and bedding plants are also starting to take an interest in it, suppliers report. The use of lava flour, which is rich in silicon, is becoming increasingly popular in soil-grown crops such as freesias.

The effects are variable, ranging from very positive to little or no effect and, very occasionally, unexpected complications. Noordam reports that albino strawberries have occasionally been seen after fertilisation with potassium metasilicate. It is therefore

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Belgian researchers highlighted an interesting point: silicon can improve the plant's overall resilience. Tomato growers are also taking an interest.

important to know what dose is required for each crop.

Crop protection

Little is known about the role of silicon in the plant in practice, and suppliers also have trouble getting the full message across. The general advice is often that it "makes the crop stronger". "But we are noticing other effects besides that," Watzeels says. "In plant sap analyses, for instance, we are seeing an impact on the uptake of potassium, calcium and trace elements.

"So besides a stronger, darker crop, you can also get better mineral uptake. But it doesn't necessarily work in every crop. We still have a lot to learn. In effect, we are making up for shortcomings in the crop protection policy. By strengthening the plant, we are essentially using fertiliser as a kind of crop protection product."

Improving resilience

As mentioned above, there is a great need to advance knowledge in this area. The researchers at the University of Ghent (Van Bockhaven et al.) therefore did the sector a favour in 2013 by ploughing through virtually all the research on silicon and publishing an article summarising the ways in which the element can improve plant resilience.

Silicon is not one of the thirteen key elements that are essential for plant growth and development, but plants absorb it naturally, and sometimes in large quantities. For a long time it was not known what they did with it. In the past, researchers had already regularly observed a positive impact on production, resilience to pests and diseases, and resistance to drought and heavy metal poisoning. But the picture differs depending on the crop and even the variety, and there was little to be obtained from the studies in terms of predictive value, let alone fertilisation advice. Nonetheless, understanding of the mechanisms of resilience is growing all the time. And since the advent of molecular techniques for discovering the effect of genes and proteins in a wide range of processes, it is becoming much clearer how this element can strengthen resilience.

Defence strategies

The Belgian researchers first highlight an interesting point: silicon can improve the plant's overall resilience to pests and diseases. That is remarkable. The plant seems to use different defence strategies against different attackers: the salicylic acid route against infestation by fungi such as mildew that parasitise on living cells, the jasmonic acid route against attack by necrotrophic fungi such as Botrytis, and insects. In many cases, "switching on" one route means that the plant's defence against other attackers is weakened. But silicon can strengthen the plant's overall resilience.

This element is therefore one of the few broad-spectrum plant boosters, as almost all other invigorators activate just one of the plant's defence mechanisms. It can also strengthen the plant's resistance to drought, heat, cold, salt and toxic stress, which in turn has a positive effect on its resilience to pests and diseases. A plant that is less stressed can defend itself better.

Active defences

It was originally assumed that the increased resistance (both to attackers and stress) was a result of silicon deposits in the leaves, which literally make the cells harder and more difficult for fungal threads or insects to penetrate. This is actually the case and is a form of passive defence.

But silicon also stimulates the plant's active defences in up to five different ways. In cucumber roots, for example, the element boosts the activity of various enzymes such as chitinase and preoxidase following infection with Phytium. These enzymes break down the cell walls of the fungus. The researchers found that the leaves of cucumber showed an increased concentration of antifungal substances that protect against powdery mildew. In rose they not only observed cell strengthening but also the formation of antibodies against mildew, with a similar picture in many other crops.

Hormone balance

A striking feature, however, is that silicon fertilisation barely stimulates the production of antibodies at all if the plant is not actually stressed. That means that while the plant is not under attack there is no loss of production because it doesn't invest excessively in defence as a precautionary measure. But it is already poised to act: as soon as an attacker approaches, the defence mechanism kicks in faster. Silicon provides the first signal, as it were, and the response only follows at the second signal – being eaten by an insect or attacked by a fungus, for example. But that response is faster and stronger than it would have been without the first signal.

Precisely how this works is still the subject of study. What is clear is that the hormone balance plays a role, but this only changes radically at the second signal, in other words when the plant is actually attacked. What's more, silicon exerts its effect through photorespiration, the iron balance and the plant's ability to flag up problems. These mechanisms also need further investigation.

Positive experiences

Our understanding of the potential benefits is therefore growing, although in practice results are often variable. The results of the research

Just a small amount of silicon can produce stronger plants.

Jan van Luijk: "The use of silicon got us started on a different way of growing."

by Dutch and Belgian institutions also often paint a changeable picture. Growers need to know more about how to use silicon properly so that they have a better understanding of when this kind of fertiliser can bring benefits.

Some growers' experiences have been remarkably positive, such as that of kalanchoe grower Jan van Luijk in Poeldijk. Like many other growers, he had had trouble with oomycetes (water moulds) in recent years. "We were really pushing to the limits despite the fact that we had started working with more viable varieties. Up until four years ago I wasn't bothered by root problems at all. As soon as that happens you get yourself a disinfector – a CH_2O unit in our case. Even so, you know it's just a short-term solution," he says.

Roots much stronger

Van Luijk discussed the problem with his suppliers and made a few changes: switching to a different potting compost, leaving the fans on for longer to make the climate more active, and applying silicon fertiliser. "The results have been phenomenal: the roots are much stronger and the flower colour is much more intense. We don't get losses any more and the plant is able to cope with anomalies such as fluctuations in pH levels much better. And we have had the disinfector on the lowest setting ever since," he says.

The grower changed three things simultaneously, but he is convinced that the main reason behind the improvement is the use of silicon. He uses one litre of Silica Power per 1,000 litres of tank liquid. "There has been a lot of discussion about this in the Calandiva study group. The results are so good that all the other growers have started using it too," he says.

More resilient way of growing

Now that the pressure from root problems has been eliminated, Van Luijk can start growing in a different way. "The sulphur pots we installed to prevent mildew are still there in the greenhouse but we haven't used them once the whole season. We don't have to, now that the plants are stronger and the climate is more active. That's almost unheard of in kalanchoe cultivation. It means we can organise our biological control much more effectively now, as the sulphur used to harm the natural predators too. So one thing has led to another, and it all started with silicon," the grower explains.

Now he has plant sap analyses carried out once a week and he can see an improvement in calcium uptake. "The bottom leaves sometimes used to turn yellow, or brown along the edges, due to calcium problems. Now we don't get any blemished leaves at all in the greenhouse. We have taken a big step forward in growing in a more resilient way."

Summary

The use of silicon is on the rise, prompted by the search for a resilient plant. Our knowledge of the role of this element is growing, thanks to new research and molecular techniques. Silicon strengthens cell walls but also puts the plant's own defences on high alert: when a pest or disease rears its head, the reaction is faster and stronger. Kalanchoe growers are already seeing great results with silicon.

Business in Trumpland

Since November of 2016, with almost every vendor from abroad, whether they're a greenhouse builder from Holland, an orchid breeder from Taiwan, or a ceramics salesperson from Canada, there comes an awkward pause in the conversation. Sometime it comes out of nowhere and the conversation might restart "So . . . Trump . . .". Other times, some piece of business conversation might lead to the same place. Either way, there I am looking at someone I've been doing business with for years, and this person is looking at me wondering if I can explain the chaos in our national government.

Well, I can't, and I don't think my first column for In Greenhouses is the best time or place to lay out my feelings on the matter (maybe some other time over a beer!). But maybe I can tell you how business is in Trumpland.

I think the main thing to understand is that, largely, it's business as usual. The United States economy continues to chug along as it did at the end of the Obama administration, with slow but steady GDP growth and low unemployment. The stock market, after a roaring start in 2017, has been flat this year. There is neither the boom that the president's cheerleaders crow about nor the impending collapse that some of his detractors would have you believe. 2017 was a good year for us. A little better than 2016.

What we do have is uncertainty. Past administrations took great pains to telegraph their intentions and policy change, when it came, was deliberate. While controversial and costly to employers, Obamacare was the result of a legislative process and a long rollout. This president, however, seems ruled by impulse. A clear example is the possible trade wars caused by unilateral declarations from the White House against not just China but Canada and the EU as well. The resulting tariffs will hit us directly and will not be easy to pass on to our customers. Also, rising budget deficits from tax reform continue to drive up interest rates, creating very real uncertainly when it comes to long-term investments.

Where does this leave a humble orchid grower? I'm not sure. Ask me again later on.

Toine Overgaag
Orchid grower in the USA