Cornell University
Cooperative Extension

Adding Silicon to the Fertilizer Program in Poinsettia Production: Benefits and Facts

Summary: the addition of potassium silicate to the fertilizer program can reduce root rot and improve the strength and post-harvest life of plants.

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What is silicon?

Researchers are currently debating whether silicon is an essential element, necessary for plants to complete their life cycle, or optional to the plant's life cycle. Essential or not, silicon does provide substantial benefits to many crops, particularly greenhouse crops, since our soil-less substrates do not contain much available silicon. Incorporating silicon into a nutrition program can improve drought tolerance, strength, disease resistance and postharvest keeping quality for many crops. Careful planning and understanding of silicon's unique role in plant nutrition will insure success with silicon.

The form of silicon taken up by plants is silicic acid which in an agricultural setting is usually supplied as potassium (K_2SiO_4) or sodium (Na_2SiO_4) silicate. These silicates should not be confused with silicone which is a polymer of silicon that is used in producing cookware and caulking among many other products.

How does silicon work in plants?

Silicon is similar to carbon in that it can make four bonds with another molecule or molecules. Scientists hypothesize that this allows silicon to take on an active role in plant defense by mimicking bioactive molecules and thus activating or speeding up pathogen defense responses. Though the exact mechanism is still unknown, it has been demonstrated that silicon supplementation decreases black spot occurrence in nursery grown shrub roses and reduces pythium occurrence in poinsettia. In addition silicon supplementation slowed leaf miner activity in chrysanthemum and herbivory in other crops such as wheat and rice.

While silicon may take an active role in plant defense responses, it has a better understood passive role in improving tolerance of abiotic stresses such as drought. After uptake by the plant, silicic acid forms solid amorphous, hydrated silica (silica gel) between the cuticle and cell wall, and between the cell membrane and cell wall. These layers are thought to act as physical barriers, something like silica armor, to evaporation and other stresses. Both corn and rice when supplemented with silicon, show marked increases in drought and heat tolerance compared to unamended plants.

What are the potential benefits for poinsettias?

Research conducted at Cornell University has shown that silicon supplementation can benefit ornamental crops as well. Poinsettias were raised under standard greenhouse conditions, but one set of plants was supplemented with 50 ppm silicon (K_2SiO_4) through constant liquid feed. During production, pythium infected several plants not supplemented with silicon yet the disease did not appear in plants supplemented with silicon. At finish, plants receiving silicon were more similar in height, though slightly shorter than untreated plants. In addition silicon supplemented plants were less susceptible to breakage. During

postharvest evaluation, plants were left un-watered for 18 days. At the end of the evaluation period, plants that received silicon during production exhibited less wilt and recovered from severe wilt without damage, compared to untreated plants. It's clear that silicon may be useful in producing an improved poinsettia crop. Further research has shown that a broad range of annuals accumulate silicon. It is likely that many of these will also benefit from silicon supplementation either through improvement of horticultural traits or water stress tolerance. Research to establish recommendations for specific species is ongoing.

How do I apply silicon?

Silicon can be delivered to plants several ways. Foliar spray application with 100 ppm silicon is sometimes used in poinsettia production to prevent bract edge burn. However, the benefit is only to the leaves and bracts, and no reports exist of silicon being transported from the leaf surface to stems or roots. Pre-incorporating silicon into the substrate before planting is an efficient method and acceptable for short term crops. Little research has been conducted to determine how long pre-incorporated silicon will persist in various substrates. Another simple way of getting silicon to plants is by including it as part of regular fertigation – typically applied at rate of 50 ppm silicon. The silicon products currently available will cause precipitation if tank mixed with concentrated water soluble fertilizers so a second injector is required or add 100 ppm Si as a weekly drench to plants.

Before using silicon supplementation with your crops, conduct small test runs. Several commercial products are available on the market, however rates and application methods can vary between species and cultivars, so testing is important. Reports of damage from high application rates are rare. One researcher reported that in sunflower high rates of silicon led to stunted plants with deformed flowers. Silicon has several known benefits for a few crops and will likely become an important tool in helping growers reduce shrink during production and in the retail environment.

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