Silicon Supplements

by Sue Bottom, sbottom15@gmail.com

Silicon supplements, what? Huh? You do not see silicon listed on fertilizer labels. It is not generally considered an essential plant nutrient because plants can grow in its absence. Silicon is known to have a beneficial effect on plants by strengthening cell walls and making them thicker, stronger and more resistant to abiotic stresses like drought and cool temperatures, as well as biotic stressors like pests and disease. Silicon is the second most common element in the earth's crust. It is minimally soluble in water so it is found in small quantities in natural water supplies. Dissolved silica is associated with soil particles in garden soil, available as roots absorb water from soil. Even small quantities are adequate for garden plants, where it is taken up through roots as uncharged silicic acid, $Si(OH)_4$, and ultimately irreversibly precipitated within the plant as amorphous silica. Dissolved silica is available to orchids when roots absorb water directly or from water absorbed to media.

1. Silica deposited in the cell tissues provides mechanical strength, so flower stems require less staking.

There are studies demonstrating the role of silicon in enhancing the growth of flowering ornamentals, including orchids. Anecdotal reports from Mark Rose of the former Breckinridge Orchids, who used potassium silicates in his fertilization program, attribute thicker leaves and stronger flower stems to silicate additions. Courtney often talks about Mark's well-grown plants with harder-than-cardboard leaves, and strong stems that did not require staking; a definite plus. The benefit of harder cell walls in preventing pathogen invasion is "icing on the cake".

Deciding how much silicon would be beneficial for orchid growth required some research. A study with commercial phalaenopsis was conducted at application rates from 25 to 100 ppm Si, with best results reported in the 25 to 50 ppm Si range (Vendrame). For comparative purposes, there is typically 3 to 20 ppm in the soil water matrix (per Epstein, Marschner). In our area of Florida, water in the surficial aquifer averages 15 ppm Si (range of 3 to 32 ppm), and the Florida aquifer averages 10 ppm Si (range of 7 to 15 ppm). You have to wonder how much silicon epiphytic orchids receive from rainwater in their natural habitat growing on trees. The only source of silicon would be the dust settling on tree leaves and trunks, decaying bark, and the silicon exuded from tree leaves that originated in the soils below. Orchids are efficient nutrient scavengers and accumulators of nutrients. Too much silicon and orchid leaves can actually become brittle. Many orchid growers consider the natural concentration of Si found in Florida waters to be adequate. However, anyone using rainwater or Reverse Osmosis water should consider adding silicates to their fertilization program. An application rate of 8 to 15 ppm Si as a

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starting point seems reasonable, pPerhaps half that much if applying as a spray. After a year or two, you can evaluate your plants and see if a higher or lower rate is suitable for your growing conditions.

There are a variety of potassium silicate products on the market. These products can be difficult to compare becomes sometimes the active ingredient may be reported as silica (SiO_2), sometimes silicon (Si) and less often potassium silicate (K_2SiO_3). If a hypothetical product contains 10% potassium silicate, it contains only 3.9% silica and 1.8% silicon, so you have to make sure you are comparing apples to apples when evaluating different products. Another problem is the application rates are given in volume of product per volume of water, but they do not specify the resultant Si concentration. If you are not comfortable with the calculations, contact the manufacturer for the silicon (as Si) concentration of their recommended dosage.

Many orchid growers are familiar with Dyna-Gro® Pro-TeKt® silicon additive that has been available for many years. This product contains 7.8% silica (as SiO_2) which is equivalent to 3.7% silicon (as Si). Dyna-Gro® suggests a Pro-TeKt® maintenance application rate from ¼ to ½ tsp/gal (0.5 to 1 ml/L), which translates to 16 to 32 ppm silicon. To be conservative, start with half the lower end application rate, 1/8 tsp/gal (0.25 ml/L), for about 8 ppm Si.

Hydroponic outlets carry a multitude of silicon supplements. The “Bloom Silica” produced by Bloom Yellow Bottle is a very concentrated formulation with 45% silica (21% Si). In fact, it is so concentrated it is labeled as a poison. At the recommended dosage of 0.33 ml/L, the irrigation water would contain 83 ppm Si, far in excess of the target amount. You would reduce the dosage to perhaps 10% of the recommended rate, or 0.03 ml/L, to have 8 ppm Si in the irrigation water. This makes it a very cost effective solution if you are comfortable with metering out the small volumes. At the opposite end of the spectrum are the very dilute formulations containing 2% silica or less (less than 1% silicon). These products are mostly water with hefty price tags. Caveat emptor!

There are also products formulated for use on turf and golf courses containing potassium silicate, some with humic acids to improve uptake through the roots and leaves. These products, like Chemical Dynamics “Dyna-Flo K-Sil” and Brandt Manni-Plex Traffic, generally have application rates given in volume per surface area, difficult to translate to orchid growers. You would have to calculate the application rate based on your desired silicon concentration or contact the manufacturer for guidance.

Silicon supplements are a little tricky to use due to their chemical nature. They are made by dissolving silica (SiO_2, or sand) in lye to form potassium silicate. This solution is very alkaline with a pH in the 11 to 12 range; it is so alkaline that some people use it as a “pH Up”. Adding silicate fertilizers to rainwater or Reverse Osmosis water can dramatically alter the pH, even to toxic levels. Whatever concentration is being used, the pH of the water being applied to plants should be checked with a pH meter to make sure it is in the desirable range.

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2. Potassium silicates will form a goopy gel when mixed with concentrated fertilizer solutions

Concentrated solutions of potassium silicates and fertilizers should not be mixed together because the silicates will polymerize to form a gel, or a colloidal silicate solution. As a general rule, do not mix the silicate solution with any other chemical. If you use a Dosatron or siphonex for applying fertilizer, alternate fertilizer and potassium silicate applications. Do not mix more than you are going to use that day. The potassium silicate product is denser than water and it will tend to settle to the bottom, so keep the solution agitated, such as with an aquarium aerator in the concentrate bucket. If you apply fertilizers with a watering can or sprayer, you can add the potassium silicate directly to your final nutrient solution.

Water with a low soluble salts content is essential for the best orchid culture. With rainwater or other sources of pure water, you have to supply everything your orchids need to grow. This likely includes a fertilizer that contains calcium and magnesium along with the other macro and micronutrients. You should also consider routine silicon supplements, at low levels to provide a steady source of silicon for developing tissue. You may find your plants are more resistant to diseases and pests as well as environmental stresses if you add silicon supplements to your nutrition program when using a pure water for irrigation.

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Citations and Additional Reading

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Dyna-Gro® Pro-TeKt® Recommended Application Rates and Calculated Concentrations		
Maintenance	Mix ¼ to ½ tsp. per gallon of water with every watering.	16 to 32 ppm Silicon
Hydroponics	Mix ½ to 1 tsp. per gallon of water for recirculating systems.	32 to 64 ppm Silicon
Siphon Mixer	(1:15 ratio) Mix ½ - 2 fl. oz. per gallon of water for a concentrate feed solution.	13 to 51 ppm Silicon (at the hose end)
Irrigation Injector	(1:100 ratio) Mix 8-10 fl. oz. per gallon of water to make an injectable concentrate. Apply Pro-TeKt® separately when using a single head injector.	31 to 38 ppm Silicon (at the hose end)
Foliar Spray	Mix ½ tsp. per gallon of water - spray directly on leaves. Note: Spot test plants first for sensitivity to sprays.	32 ppm Silicon