

## **Silica, silicate, silicon, monosilicic** $\text{Si(OH)}_4$

**Silicon (Si):** Widely used common chemical element, important plant and human nutrient. In plants it's primarily used for strength and defence, but also plays several important metabolic roles. In short, plants that receive supplemental silicon in the way we apply other nutrients do measurably better than those that go without - often tens of percent improvements on a range of metrics from size, growth rate, fruit quality and quantity, but above all, resilience to stressors of all sorts from disease and pests to heat, cold, drought, and wind. This directly benefits growers but also allows significant reductions in fungicide and pesticide use resulting in cleaner, less polluting operations overall.

**Silicone:** Silicon + synthetic plastic polymers: for bathrooms and kitchens. Not for plants.

**Monosilicic acid (MSA)  $\text{Si(OH)}_4$ :** The naturally 100% plant available form of silicon: i.e silicon in the form that plants naturally take up. All other forms of silicon have to break down or be broken down into mono over time before they can be used by plants. Applying Mono directly shortcuts the process and delivers silicon in the exact form plants have evolved to use.

**Stabilized monosilicic Acid:** Mono is unstable by nature, and so to be able to bottle it and / or use it at high concentrations, you need a stabilizing formula to stop it turning back into non-available compounds like Silica. In the 1990's researchers noticed that Molybdenum can capture some of the tiny traces of mono that naturally come from Potassium and other silicates in solution, getting the concentration up from zero point zero something percent, to around one percent. That's the First Generation of practical stabilization tech to be developed, we call it Gen 1 Mono.

1% strength MSA may not sound like much, but it was a revolution: silicates are often applied in tons per acre. Gen 1 mono reduced that to tens of liters or less to deliver better results, and the Gen 1 Potassium Silicate Molybdenum formula is still dominant in hydroponics. Used by all the biggest brands it offers huge profit margins thanks to ingredient costs in the pennies and sale prices often north of \$200.00 per liter.

The biggest drawback to Gen 1 Stabilized MSA (outside of the very high price vs % content) is that it still has all the usage drawbacks of the Potassium Silicate it's based on: it is highly reactive, needs to be mixed with water first and pH adjusted, often can't be mixed with other products, precipitates very easily blocking drippers and pipes, and it's fundamentally limited to around 4% max strength by its water based chemistry.

Whilst most companies were piling onto the bandwagon of cheap Gen1 products (or selling straight silicates under deliberately confusing names - see “silicium”), a lone UK Sustainable Agritech company was investing heavily in research to do better, and in the late 2010’s Gen 2 Mono was born: 40% strength for the same price per liter as 1% Gen1 products (40X better value), and because it’s NOT just more Potassium Silicate in water, it shares none of the usage limitations that plague Gen 1 products. It’s pH neutral, and instead of a load of rules, it’s as simple as adding one drop per liter of water before watering or feeding your plants - and that’s what we sell

**Silicium (Si):** Old name originally proposed for silicon in 1808. Still the French word for Silicon today. Confusing if you’re not in France. Used in marketing to make basic Potassium Silicate Sound like a monosilicic acid product so it can be sold for a higher price.

**Silica (SiO<sub>2</sub>):** Silicon dioxide aka quartz beach sand: a compound of silicon and oxygen. Very stable and so very hard for plants to pull usable silicon out of unless it’s powdered very fine and exposed to high pH / active microbiology. Useful for bulk Silicon addition to depleted soils but not a plant treatment with effects that can match the plant available form of Silicon: MonoSilicic Acid. Because industry marketing departments think people aren’t smart enough to understand long words, “Silica” is now used to refer to almost all Silicon nutrients, most of which aren’t Silica - and wouldn't work if theory were, because as most people know from experience with sand: it doesn’t dissolve very well in water (!) and unless things are soluble in water or fat, plants (and animals) can’t use them. Ironically, Silica is what MSA turns into once in position in plant structures - because it’s not soluble. This can lead to the confusion over “organic” silica from plants which is by definition not soluble - or for example stinging nettle needles would dissolve in rain.

**Silicates (SiO<sub>4</sub>):** A wide range of silicon/oxygen compounds often with calcium, or potassium. Common industrial Si fertilizer. Hugely more soluble than Silica, but still far from the best source of easily available Silicon. When silicates are in contact with water, especially at low pH, a tiny quantity of monosilicic acid (one single silicon atom with a few hydrogen and oxygen atoms around it) is released. After several weeks, that will be enough to start having a noticeable albeit limited effect on plants. This is how all silicon silicate and “organic” Si sources work, and why monosilicic acid is the shared link between them all.

**Orthosilicic acid Si(OH)<sub>4</sub>:** Another name for monosilicic acid, older, tends to be used more in Biology, and by companies looking to confuse customers.