

# Silicate Products

Approximately 30% of the Earth's crust is silicon (Si), and after oxygen it's the most abundant element. Even so, very little of what is found in soil is in a form that plants can utilize. As with all nutrient, silicon must be in a soluble form for the root to take it in so that the plant can utilize it. Based upon research, on average, only ½ to 1 pound per acre releases to become plant available during any single growing season. Historically ignored as an agronomic nutrient, more recent research has strongly indicated that perhaps Si may play an important role in several significant areas of plant nutrition and overall physiological activity.

One example states, "Recent studies into the mechanisms by which silicification proceeds have identified the following: an energy-dependent Si transporter; Si as a biologically active element triggering natural defense mechanisms; and the means by which abiotic toxicities are alleviated by silica. Understanding of the effect of the 'element' on plant growth may lead to improved yields and resistance to disease for a wide range of higher plants." (Heather A. Currie & Carole C. Perry, *Biomolecular and Materials Interface Research Group, School of Science and Technology, Nottingham Trent University, 2007*)

## What does silicon do in plants?

Silicon is now listed as a biostimulant by the European Biostimulant Council based upon its numerous roles in plant physiological activities. But with the growing evidence of continuing research, and based upon amounts found in plant tissue Si is beginning to be recognized as perhaps fitting into plant nutritional requirements with other secondary nutrients, calcium, magnesium and sulfur.

Although vine crops are currently known as the greatest accumulators, all plants take up silicon and utilize it in the construction of cell walls which greatly contribute to a plant's structural strength. "Plants deprived of Si are often weaker structurally," (Epstein 1999). Increasing available (or soluble) Si directly increases the amount deposited in cell walls. It then becomes part of the wall matrix; making the cell stronger. In addition to this structural role, Si appears to protect plants from both insect attack, and specific diseases, plus aiding the plant's ability to withstand environmental stress.

## Specific benefits from increased silicon nutrition:

- **Decreases weather and other abiotic stresses**
- **Can counteract the negative effects of excessive N.**
- **Improves photosynthesis and increases brix**
- **Improves plant growth thus increasing yield**
- **Enhances reproduction by increasing pollen fertility**
- **Higher brix and crop quality**

As part of numerous plant metabolic activities/processes, Si directly benefits overall plant health, stimulating plant growth and yields, and will supplement the activity of traditional biostimulants such as MetaboliK HV-1, MetaboliK Seed Boost, and the humic acids.

- **Aids in the control of fungal diseases by protecting against or limiting fungal colonization sites**
- **Can be used as an organic fungicidal product**
- **Protects the plant from Botrytis, Powdery Mildew, Cercospora and other disease**

While not a "chemical" fungicide or pesticide, increasing Si levels in and on plant tissue appears to support an overall pest management, or IPM, program. This effect seems especially strong in vine crops such as melons, pumpkins, winter squash, cucumbers and summer squash. There are many reports, as well as our own observations, that increasing Si levels, using preventative applications, greatly assisted powdery mildew management in these crops.

Substantial research indicates that silicon may also provide some protections against other pathogens that cause foliar diseases, such as blights, blight, leaf spots including Cercospora, rusts, Botrytis and stem rots and root diseases, including Pythium and Phytophthora. This is an area that we are continuing to study, but we have found that when using silicate as a foliar additive, a more complete coverage of the leaf provides the greatest protection.



*Powdery mildew on pumpkin. When used as part of a control program, SiGuard has shown to significantly improve control.*



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Other research indicated that silicate taken into the plant can be mobile and acts as further control of damaging disease. When penetration of the inner epidermal layer was pierced by a powdery mildew organ, soluble silicate inside the plant was transported to the site of penetration and effectively "surrounded" the penetration site thus stopping the ability of the pathogen to feed upon plant cell nutrients and/or metabolites.

NOTE: Although speculative, controlling several plant diseases through enhancement of natural protective and/or defense mechanisms may be important in the overall battle with disease. There is no question that the overuse, or misuse, of chemistries can quickly result in the building of, or creation of, pathogen resistance. We have seen this with a wide variety of pests, including weed, disease and insect species. Even the use of copper as a bactericide is becoming less effective as a large number of bacterial organisms have modified themselves to be tolerant to copper. But it is logical to assume that pathogens will have at the very least difficulty in building resistance to stronger physical barriers, or natural plant defense mechanisms.

**- An ideal fit for Integrated Pest Management (IPM) programs because of its activity against aphids, mites, thrips, white flies and other small piercing insects**

**- Silicate has been shown to be safe on beneficial predators**

Research indicates that Si applications aid in the suppression of aphids, mites, western flower thrips and other small sucking insects and mites. Si makes plant tissue tougher through incorporation into plant cell walls. This can be very important for several reasons, the first being the obvious damage that these pests can cause in the reduction of viable leaf tissue and the drain upon plant energy, but also the damage to fruiting forms and reduction in marketable fruits.

In addition, many of these insects such as aphids, thrips, and whiteflies are known vectors, or carriers, of viral infections. There is no know treatment for viral infections, and it always causes the complete destruction of the infected plant to ensure that the disease can be controlled or limited in spread. Elimination of, or at least a serious reduction in the numbers of, pest populations is the only known control of viral disease.

Plants have a variety of defense mechanisms. One of the primary defenses is the integrity of the epidermal layers. Many disease organisms are often present, but are somewhat opportunistic, in that they are unable themselves to penetrate the plants epidermis. But once this layer has been damaged, or in other words a "wound" has been opened, the pathogen can then easily take advantage of this wound and infect the plant. There is also research indicating that additional silicon aids in the production of both longer and more leaf hair, which is a natural defense against certain leafminers, stem borers, beetles and their larva.

**- Alleviates a number of abiotic stresses such as lodging of small grains, drought, temperature extremes and chemical stresses such as high salt levels and nutrient imbalances.**

**- Aids in the control of root knot and sting nematodes**

#### Are you or have you been Si deficient?

It's difficult to look at a crop and say that it is Si deficient. Increased lodging and susceptibility to powdery mildew could be one indicator. A greater number of labs are offering Si testing now, so contact your laboratory to see if they are able to include Si levels in your testing package.

**Other general information:** Industry research shows adding silicon to potting mixes improves the overall health of plants, prompting the American Plant Food Control Officials to look at silicon in "a new way" and endorse it as a beneficial substance. SiGuard can be added as part of an artificial potting mixture for use in planting seeds and/or cuttings for transplanting. The recommended rate is 2 - 4 ounces per cubic yard of growing medium. Industry research indicates that adding silicate to the growing environment as early as possible followed by subsequent applications provides the greatest benefits. SiGuard may also be used as a "drench" for seedlings at a rate of 4 - 8 ounces per 100 gallons of drench solution.

(Calibrochoa and/or petunias require rather large amounts of magnesium for optimal growth. If growing these flowers, it is advisable to replace SiGuard with SiMag 58).



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**SiGuard** is a soluble powder containing 84% available silicate, and is our premier choice for silicate additive. Foliar applications at ½ - 2 teaspoon per gallon will provide a coating activity that supports the activity of pesticides in managing specific insects, mites and plant diseases. Application through fertigation or drenches at a rate of 8-12 oz per acre applied every 7-14 days along with other plant nutrients will substantially boost plant Si tissue levels. SiGuard is packaged in a durable, gasketed 16 pound pail.

**SiMag58** is a soluble powder containing chelated Mg combined with potassium silicate providing 5% K, 5% Mg, plus 8% Si. The Mg is highly available both through foliar applications and fertigated. While some Si will move into plant tissue translamarily (through the leaf), fertigation is the best way to build plant Si levels.

SiMag58 is packaged in convenient 4 pound gasketed pails. Typical application rates are 1-2 teaspoon per gallon of foliar solution and 8-12 oz per acre fertigated.

The chelated Mg in SiMag58 is the ideal solution to quickly solve low Mg tissue levels. Combining foliar applications with fertigation will rapidly repair low Mg levels. Low Mg levels are very common in tomatoes, melons and other produce crops. Bringing tissue levels of Mg into balance with Ca and K can greatly improve fruit quality and plant vigor. If additional Mg is not needed then SiGuard is your Si material of choice.

**SiMan 911** is a soluble combination of potassium silicate and EDTA chelated manganese. Containing 9% Mn, SiMan 911 will be of significant benefit when your plants are suffering from manganese (Mn) deficiency.

SiMan 911 is packaged in a convenient 4 pound gasketed pail. Although specific application rates will vary based upon actual manganese deficiency, typical application rates are 1/2 - 1 teaspoon per gallon of foliar solution, or 8 - 16 ounces per acre fertigated.



*Greenhouse and/or tunnel growing environments are often hotspots for a variety of mildew and mold disease issues, as well as infestations of aphids, thrips, mites, whiteflies and other small insect pests. Although ensuring adequate silicon is important in all growing situations, it can be especially important in these types of "artificial" environments.*

## Grower Comments:

"Thank you for your silica products ... they have made a huge difference on our produce farm."  
- J.E.T.S., Indiana

"Very good success with SiGuard in the seedling greenhouse; no fungus gnat or disease pressure."  
- J.T., Indiana

"I love your SiGuard product. It slows down the spread of powdery ... allows me to pick an extra 10 days in my zucchini fields, which makes me quite a bit of additional profit."  
- J.J. Farms, Michigan

"With SiMag58 we see powdery mildew hardly spread, instead of rapidly spreading before using the silicates."  
- E.B., Missouri



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