SILICON: a Biocontrol Agent that **Boosts Plant Immunity**

Biological plant protection can come from some unexpected sources. This trace element can help shore up your crop's defenses against both insect and disease pests.

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UALITY AND PROFITABILITY are two important factors that drive our agricultural markets. We have fine-tuned our cultivation processes over centuries to obtain higher yields with lower inputs to protect both our environment and our bodies.

The biocontrol market contains a diverse set of less-toxic alternatives to aid in the overall goal of environmental stewardship. One set of materials contain a bioavailable form of silicon, important for enhancing the plant's natural immune system.

Silicon is an essential trace element important for animal and human health. It also has an important role in plant health.

SILICON PROTECTS AGAINST SOME DISEASE AND INSECT PESTS

Studies show that adding silicon to the growing media significantly reduces the presence of powdery mildew in a variety of plants, including cucumber, tomatoes, strawberries, grapes, melons, and lettuce. This nutrient also protects against bacterial and

Diseases	Pathogens	Hosts
Alternaria	Alternaria alternata	Melon
Angular leaf spot	Pseudocercospora griseola	Bean A3
Anthracnose	Colletotrichum lindemuthianum; C. orbiculare, C. acutatum	Bean, Cucumber, Strawberry
Bacterial fruit blotch	Acidovorax citrulli	Muskmelon
Bacterial speck	Pseudomonas syringae pv. Tomato	Tomato
Bacterial spot	Xanthomonas axonopodis pv. Passiflorae	Yellow Passion fruit
Bacterial wilt	Ralstonia solanacearum	Tomato
Black rot	Didymella bryoniae	Cucumber
Brown spot	Monilinia fructicola	Peach
Crown and root rot	Pythium ultimum and P. aphanidermatum	Cucumber
Downy mildew	Bremia lactucae	Lettuce
Fusarium wilt	Fusarium oxysporum spp., F. semitectum	Cucumber, Lettuce, Melon, Tomato
Gray mold rot	Botrytis cinerea	Cucumber
Gummy stem blight	Didymella bryoniae	Watermelon
Leaf spot	Mycosphaerella pinodes	Pea
Pestalotia leaf spot	Pestalotia longisetula	Strawberry
Phytophthora root rot	Phytophthora cinnamomi, P. sojae, P. capsici	Avocado, Soybean, Bell Pepper
Pink rot	Trichothecium roseum	Melon, Muskmelon
Powdery mildew	Podosphaera xanthii, Uncinula necator, Sphaerotheca xanthii, S. macularis, Oidiopsis sicula, Oidium neolycopersici	Cucumber, Grape*, Melon, Muskmelon, Pumpkin, Strawberry, Tomato*, Zucchini Squash
Pythium root rot	Pythium aphanidermatum	Bitter gourd, Tomato
Stem blight	Phomopsis asparagi	Asparagus

Adapted from F. A. Rodrigues and L. E. Datnoff. Silicon and Plant Disease. 2015. Springer *In some cases (e.g., Fusarium wilt in tomatoes, or powdery mildew in grapes or tomatoes), results of research were inconclusive. The form and concertration of silicon in addition to the disease pressure added and age of the plant all can influence the outcome of the studies.

viral infections in certain plants.

Not only does silicon protect against disease, it also reduces the population of insects and mites feeding on silicontreated plants.

For many years, it was thought that silicon provided a physical barrier associated with the plant cuticle, making it harder for insects to penetrate.

While this process is involved, recent studies show that arthropods feeding on silicon-treated plants produce fewer offspring, suggesting that silicon is altering some aspect of the plant material ingested by these menaces. Combining silicon with other biocontrol agents may lead to better protection and control over infestations.

TIPS ON GAINING NUTRITION FROM SILICON

There are many forms of silicon that can be taken up by plants.

Commercially available products include: Solid materials for media incorporation that come from mined rocks (wollastonite and ignimbrite)

Recycled slag from the steel industry (also containing additional micronutrients and used as alternative liming agents)

Recycled glass (used as solid substrate in hydroponics or aquaponics)

Plant material (including rice hulls, coir, and biochar produced from plant material).

Liquid materials that can be applied as a media drench or foliar spray (including potassium-, sodium-, and calciumsilicates).

These materials have unique characteristics and release varying amounts of plantavailable silicon. It is important to match the material with your growing system.

The amount of silicon required to enhance growth and stress resistance varies greatly by plant type and even variety. There are no current recommendations for silicon concentrations in plant tissue.

As a general rule of thumb, many of

the grasses and grains need large amounts (and can take up to 100,000 ppm or higher silicon), while dicots range in their foliar concentrations from 10,000 ppm (in cucumber) to 100 ppm (in onion). It is important to note that silicon protects both cucumber and onion in various stress responses, showing that foliar concentration does not predict protection.

Silicon fits in as a biocontrol because it enhances the plant's own immune response, allowing for a faster and more robust response to invading pathogens or herbivores. By providing plants with this nutrient prior to the onset of disease or early in the detection of nuisance arthropods, we can help our photosynthetic friends maintain their quality and vield. even in the presence of stress.

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