

GROWERTALKS

Growing With Griffin

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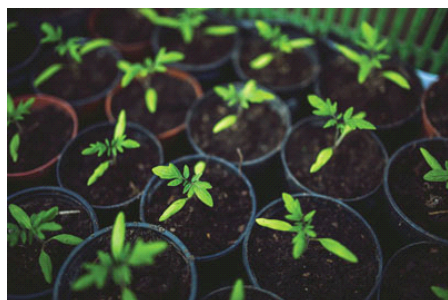
The Plants Strike Back: A SAR Wars Story

Karen Stever

Plants have defense systems that are activated when a plant is infected by a pathogen or suffers insect damage. The attack on the plant sets off a signal, which is carried through the plant in the form of a small molecule, such as salicylic acid, jasmonic acid or ethylene, for example.

The exact chemical signal is dependent upon the plant type and the nature of the attack. Is it an insect or a pathogen? Is it a pathogen that kills plant tissue, such as Pythium or Fusarium, or a foliar infection like rust or powdery mildew? The answer determines which chemical signal is sent and initiates a cascade of biochemical reactions within the plant, which can be quite wide-ranging. For example, the plant may produce an elevated level of antifungal proteins or reinforce its cell walls with cellulose, lignin and proteins.

The observable effect of this chemical signal is termed Systemic Acquired Resistance (SAR). Think of SAR as the immune response of a plant; it's comparable to our own immune systems in that the immunity or resistance generated may be long- or short-lived and the degree of resistance will vary by organism being presented.



A number of plant-protection and fertilizer products can trigger the signals of the SAR pathways in plants; these products range from small molecules to living organisms. The defense signal(s) can be elicited by small molecules, such as potassium phosphite, thiamine or potassium silicate.

Pictured: Tomato is among several crops that can be sensitive to excess silicate. Others include begonia, geranium, gerbera, pansy and petunia.

Potassium phosphite fungicides, such as Fosphite and Alude, have undergone the rigorous testing required of registered fungicides (as well as the test of time). They're well-known for their efficacy in preventing Pythium and Phytophthora, and for stimulating root growth. In part, the activity is due to induced resistance by the phosphite.

Thiamine, or vitamin B1, is also capable of inducing a SAR signal. Thiamine is just one of many plant-boosting ingredients in the nutritional supplements like Essential Organic 1-0-1 (formerly called Essential Plus). Potassium silicate and potassium phosphite are supplied in SilGuard (0-2-5), Pro-TeKt and many other products.

Silicate, phosphite and salicylic acid—all three—are provided in the supplement SiTKO SA 0-7-17 to directly target the resistance pathways in your crops. Some common bedding plants can be sensitive to excess silicate—including begonia, geranium, gerbera, pansy, petunia and tomato—so it's important to observe label rates and precautions of

the many available products.

More complex natural products—such as extracts of kelp, algae or certain terrestrial plants, as well as biochar (created by pyrolysis of wood or other plant material)—have been shown to improve crop performance. The improvement seen is, in part, due to the ability of the materials to induce resistance signaling in the plants, along with any nutritional benefit, of course. Kelp supplements can be single-ingredient or blended into complex products, such as Growth Products' Essential Organic 1-0-1, a root and plant stimulator product. Essential Organic is a complex product combining many beneficial ingredients for plant health, in addition to those that may elicit resistance.

Another professional product based on plant extracts is Regalia PTO fungicide. Regalia is derived from extracts of the giant knot weed, *Reynoutria sachalinensis*. Regalia PTO has been shown to protect plants through induced resistance. It's effective against a large number of fungal and bacterial pathogens and can be used as a spray or a drench.

EcoSwing, a new product from Gowan, is an extract of *Swinglea glutinosa*, a type of citrus plant. This product has shown excellent results for powdery mildew, Botrytis and rust (per Ann Chase). Research indicates induced resistance is part of EcoSwing's mode of action.

Even more complex interactions occur between plants and the living bacteria and fungi we use as plant protectants, including *Bacillus* species, Trichoderma species, mycorrhizae mixes and others. Actinovate, Companion, Cease, Triathlon BA, RootShield and RootShield Plus are all registered fungicides that utilize microbe-to-plant interactions to protect the plant from infection.

Products based on *Bacillus* bacterial strains provide root and foliar protections due to multiple mechanisms, at least one of which is induction of the plants' own resistance pathways. *Bacillus* fungicidal products include Companion, Cease and Triathlon BA. Similarly, the RootShield products, based on a Trichoderma fungus, are used for protection against root rots and they've also been shown to reduce the need for foliar fungicide applications.

Plant Probiotic and Plant Biotik products, biological soil supplements from Nature's Source, both combine *Bacillus*, Trichoderma and other organisms in a soil amendment aimed at growth stimulation. This is just one of the many possible combinations found in these supplemental products.

Other products, such as SC 27, combine Streptomyces and *Bacillus*. These multi-microbial formulations aid in nutrient uptake and reduce plant stress, in part at least, by inducing the resistance system of the plant. These products are sold as supplements or fertilizer enhancers and haven't been rigorously tested as the registered fungicides.

Mycorrhizae also have plant health benefits, mainly through nutritional pathways. These organisms colonize the root systems of up to 80% of all plant species in nature. Endomycorrhizae colonize inside of the root cells and are most prevalent, while ectomycorrhizae are associated with the root surface and are most prevalent in interaction with hardwood and conifer trees.

The organisms form threadlike chains that function as extensions of the root, delivering water and mineral nutrients to the plant. In the symbiotic relationship that occurs, the plant feeds the mycorrhizae with sugars and more complex nutrients. Observed benefits include improved plant health and more efficient nutrient usage, both of which may lower the costs for fertilizer and fungicides. Mycorrhizae organisms won't colonize all plant species equally and mycorrhizae products should be an appropriate mix for the plants being inoculated. The company Mycorrhizal Applications, as an industry leader in this area, has assembled extensive lists of mycorrhizal plants that are available on their website, www.mycorrhizae.com.

Analogous to vaccines and human immunity, products that utilize induced resistance should be thought of as preventative, reducing the overall need for curative actions and improving plant health. However, in limited cases, research has shown some curative properties. Many of these products work by multiple mechanisms researchers are still striving to understand. However, the current state of our knowledge shows that tapping into the plants' ability to launch a defense can benefit your growing operation with healthier plants and reduced usage, and therefore longer lifetimes, of chemical fungicides. **GT**

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