



### Some Factors Concerning Pesticide Compatibility with Biological Control Agents

A frequent question from growers is whether pesticides can be used with biological control agents. Sometimes, biological control programs may fail for several reasons and the pests still need to be controlled. If the incoming plant material has toxic pesticide residues, or if there is a missed shipment of biological control agents that need to be released on a regular basis (i.e. weekly), or an immigration of pests from outside (for example, western flower thrips in the summer months), biological control programs can sometimes fail. For some pests, effective biological control agents are not yet available. Effective, consistent, and reliable biological controls are still lacking for foxglove aphids (at least on certain plants such as calibrachoa), long tailed mealybugs, and certain scale insects. New or secondary pests may suddenly appear or be introduced on plant material and still need to be managed.

However, this is a complex issue and the answers depend upon several factors. Keep in mind that natural enemies are more active searching for prey and grooming than pests, so will have more contact with pesticide residues! In general, parasitoids (such as *Encarsia Formosa*) may be more sensitive to wet sprays than predators. The species of natural enemy and life stage is very important. The type of predator can also be a factor. Does the predator consume the entire prey insect or just part of the prey?

The type of pesticide (insecticide, miticide, fungicide or plant growth regulator) and formulation and mode of action is also important. In some cases, the harmful effects may not be due to the active ingredient of the pesticide, but due to inert ingredients such as additives, surfactants, carriers, emulsifiers and/or solvents. For example, xylene, which is present in the formulation of the insect growth regulator kinoprene (Enstar AQ), may be toxic to some natural enemies, especially parasitoids. More information is generally available about the impact of insecticides and miticides than fungicides or plant growth regulators on biological control agents.

Pesticides have direct effects such as killing the natural enemy or causing their non-emergence from eggs or pupae. Pesticides can also have indirect or sub lethal effects on the natural enemies. If the pesticide kills their food source or prey, then the natural enemies may starve or disperse from the greenhouse. Parasitoids may also be killed while developing inside their hosts. Certain pesticides may have repellent activity, which influences the ability of the biological control agent to locate prey.

Pesticides may also indirectly affect the ability of natural enemies to survive and reproduce. For examples, some pesticides may sterilize females, reduce their ability to lay eggs, or modify the sex ratio so there are fewer females. Development or longevity may be reduced.

In general, some alternative pest control materials may be more selective and less harmful to certain natural enemies than conventional pest control materials. Microbial biopesticides may be compatible with some, but not all, natural enemies. For example, *Beauveria bassiana* (BotaniGard WP) sprays are considered "generally safe" against the predatory mites, *N. cucumeris* and *A. swirskii* but not with the predatory bug, *Orius*.

However, wet sprays of insecticidal soaps and horticultural oils are generally toxic to many biological control agents, especially parasitoids (although once the spray residues dry, they are less harmful).

Preventive biological fungicides such as *Trichoderma* (Rootshield and Rootshield Plus) are not reported to interfere with the introduction of biological control agents into the soil media and *Bacillus subtilis* (Cease) is not reported to interfere with some natural enemies according to Bioworks. In addition, traditional fungicides with broad modes of activity may be more detrimental to natural enemies than fungicides with site-specific modes of action.

The use of paclobutrazol (Bonzi) resulted in compact plants that were more difficult for the parasitic wasp, *A. colemani*, to search, so they had trouble finding the aphids to parasitize. This resulted in increased aphid abundance on treated plants in recent studies.

Never use the highly toxic insecticides such as organophosphates, pyrethroids and carbamates that can have a persistence of 4 months or more! Before beginning a biological control program, growers need to avoid use of these products for 3 to 4 months.

There is often a transitional period before beginning a biological control program. Some pesticides are that are not compatible with biological control agents but have a short residual (two to three weeks) can be used to clean up existing problems before introducing natural enemies. Some examples include abamectin (Avid), pyridaben (Sanmite), dinotefuran (Safari), and imidacloprid (Marathon).

If you absolutely need to treat, spot treat whenever possible. Spray drift can have unintended consequences. Never spray your banker plants! Remove them from the greenhouse before spraying.

### **For more information**

The major suppliers of biological control agents have developed “side effects” databases, either online or as downloadable apps. These side effects databases list a range of toxicity from not harmful (less than 25 % reduction), to moderately harmful (25 to 50 % reduction), to harmful (50 to 75 % reduction) to very harmful (greater than 75% reduction).

When consulting the side effect databases, you may notice different results for the same pesticide depending upon the source. Be cautious and follow the most conservative results. Testing is ongoing, so if the information is not listed in one of the databases, contact your biological control supplier for more information.

Refer to online databases or apps such as those maintained by:

- Koppert’ s online interactive database: <https://www.koppertus.com/side-effects-database/>
- Biobest: <https://www.biobestgroup.com/en/side-effect-manual>

- Bioline Agrosciences <https://www.biolineagrosciences.com/> (download Bioline app)
- BASF: [BASF Nemasys Beneficial Nematodes Chemical Compatibility Guide.](#)

Research is continuing the compatibility of pest control materials with natural enemies so be sure to contact your university-based entomologist or biological control supplier.

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