



Biological Control Agents (BCAs)

Use with BioWorks Products:

BotaniGard® 22WP | Mycotrol® WPO | Molt-X® | SuffOil-X®
RootShield®, RootShield®PLUS+ | BotryStop® | CEASE® | MilStop®SP

The introduction of Biological Control Agents (BCAs) is often the first line of defense and a key component of an Integrated Pest Management (IPM) strategy, either in greenhouses or open field crops. Understanding the potential impact of BioWorks products over BCA species is essential to the success of a pest management program. This document provides important insight on the possible side-effects of BioWorks biopesticides on most used species of BCAs, and the best way to minimize the risks associated with using both components as part of a pest management strategy.

Please refer to product labels for complete application details. Always read and follow label directions.

BCAs and their use with Insecticides

BotaniGard 22WP and Mycotrol WPO foliar sprays

BotaniGard 22WP and **Mycotrol WPO** are effective biological insecticides that are used to control many insects. They are based on the highly successful fungus, *Beauveria bassiana* strain GHA. Its spores infect the soft body of many pest insects when in contact with the external cuticle. It is essential for growers to be able to assess how they use this product as part of their IPM program, for example, as a spot treatment or by broad application.

Genus, species	Type	Recommendation
<i>Amblyseius</i> (= <i>Neoseiulus</i>) <i>andersoni</i>	predatory mite	Ok to apply
<i>Amblyseius californicus</i>	predatory mite	Ok to apply
<i>Amblyseius cucumeris</i>	predatory mite	Ok to apply
<i>Amblyseius fallacis</i>	predatory mite	Ok to apply
<i>Amblyseius swirskii</i>	predatory mite	Ok to apply
<i>Aphelinus abdominalis</i>	parasitic wasp	Ok on mummies Some reduction of adult population. Wait until mummification is extensive before applying.
<i>Aphidius colemani</i>	parasitic wasp	Ok on mummies Some reduction of adult population. Wait until mummification is extensive before applying. Avoid application to banker plants.
<i>Aphidius ervi</i>	parasitic wasp	Ok on mummies Some reduction of adult population. Wait until mummification is extensive before applying.
<i>Aphidoletes aphidimyza</i>	predatory midge	Use only with high population. Expect reduction after application. Re-introduce after application.
<i>Bombus</i> spp.	bumblebee	Ok to apply Close the hive before application.
<i>Chrysoperla rufilabris</i>	predatory lacewing	Apply 5 days prior to release.
<i>Cryptolaemus montrouzieri</i>	predatory beetle	Ok to apply Expect reduction after application.
<i>Dalotia</i> (= <i>Atheta</i>) <i>coriaria</i>	predatory beetle	Apply prior to introduction of <i>Dalotia</i> . Do not re-apply after introduction.

BotaniGard 22WP and Mycotrol WPO foliar sprays *continued*

Genus, species	Type	Recommendation
<i>Dicyphus hesperus</i>	predatory bug	Apply prior to introduction of <i>Dicyphus</i> . Do not re-apply after introduction.
<i>Diglyphus isaea</i>	parasitic wasp	Ok to apply; wait for adult population to increase. Expect some reduction.
<i>Encarsia formosa</i>	parasitic wasp	Ok with parasitized pupae. Expect reduction of wasps after application.
<i>Eretmocerus eremicus</i>	parasitic wasp	Use only with high population of parasite. Expect reduction of wasps.
<i>Feltiella acarisuga</i>	predatory midge	(no information available)
<i>Heterorhabditis bacteriophora</i> NemaShield® HB	entomopathogenic nematode	Ok to apply Ok to tank mix
<i>Orius insidiosus</i>	predatory bug	Apply prior to introduction of <i>Orius</i> . Do not re-apply after introduction.
<i>Phytoseiulus persimilis</i>	predatory mite	Ok to apply
<i>Rhopalosiphum padi</i>	alternative host to aphid parasitic wasps	DO NOT APPLY TO BANKER PLANTS.
<i>Steinernema carpocapsae</i>	entomopathogenic nematode	Ok to apply
<i>Steinernema feltiae</i> NemaShield®	entomopathogenic nematode	Ok to apply
<i>Stratiolaelaps scimitus</i> (formerly <i>Hypoaspis miles</i>)	predatory mite	Ok to apply
<i>Trichogramma</i> spp.	parasitic wasp	Ok to apply

Molt-X

Molt-X is an emulsifiable concentrate containing 3% azadirachtin, which is an active ingredient derived from the seeds of the neem tree. As an Insect Growth Regulator (IGR), it interferes with the key molting hormone, ecdysone, preventing insects from progressing from one life stage to the next.

Genus, species	Type	Recommendation
<i>Amblyseius</i> (= <i>Neoseiulus</i>) <i>andersoni</i>	predatory mite	Ok to apply
<i>Amblyseius californicus</i>	predatory mite	Ok to apply
<i>Amblyseius cucumeris</i>	predatory mite	Ok to apply
<i>Amblyseius swirskii</i>	predatory mite	Ok, but some population reduction
<i>Aphelinus abdominalis</i>	parasitic wasp	Ok to apply
<i>Aphidius colemani</i>	parasitic wasp	Ok to apply
<i>Aphidius ervi</i>	parasitic wasp	Ok to apply
<i>Aphidoletes aphidimyza</i>	predatory midge	Do not apply
<i>Bombus</i> spp.	bumblebee	Ok. Close the hive before application.
<i>Chrysoperla</i> (<i>Chrysopa</i>)	predatory lacewing	Ok to apply
<i>Cryptolaemus montrouzieri</i>	predatory beetle	Ok to apply
<i>Dicyphus hesperus</i>	predatory bug	Ok, but some population reduction
<i>Diglyphus isaea</i>	parasitic wasp	Ok to apply
<i>Encarsia formosa</i>	parasitic wasp	Larva = 1 Adult = 2 (*)
<i>Eretmocerus eremicus</i>	parasitic wasp	Ok to apply

Molt-X continued

Genus, species	Type	Recommendation
<i>Feltiella acarisuga</i>	predatory midge	Larva = 1 Adult = 2 (*)
<i>Heterorhabditis bacteriophora</i> NemaShield® HB	entomopathogenic nematode	Ok to apply; Ok to tank mix
<i>Orius insidiosus</i>	predatory bug	(Data not available)
<i>Phytoseiulus persimilis</i>	predatory mite	Adult = 1 Larva = 2 (*)
<i>Steinernema feltiae</i> NemaShield®	entomopathogenic nematode	Ok to apply
<i>Stratiolaelaps scimitus</i> (formerly <i>Hypoaspis miles</i>)	predatory mite	Larva = 1 Adult = 2 (*)

*See Toxicity Rating Chart below

Toxicity Rating Chart*

IPM Impact Rating ¹	Mortality /Reduction	Toxicity
1	<25%	Non-Toxic
2	25-50%	Slightly Toxic
3	50-75%	Moderately Toxic
4	>75%	Toxic

1. Side-effects Database, IPM Impact, 2019

SuffOil-X

SuffOil-X is a light horticultural oil used to control insects, along with providing suppression of certain foliar diseases. It is expected that it will harm beneficials, but due to the lack of residue after application, BCA populations can recover. Releases can occur after 24 hours from SuffOil-X application. This product becomes very useful in an IPM program for spot treatment of insects.

BCAs and their use with Fungicides
RootShield or RootShield PLUS

RootShield/RootShield PLUS - The RootShield family of products is used to prevent the development of root diseases causing damping off. They will not interfere with the introduction of BCAs inhabiting the soil/growing mix.

Genus, species	Type	Recommendation
<i>Heterorhabditis bacteriophora</i> NemaShield® HB	entomopathogenic nematode	Ok to apply; Ok to tank mix
<i>Steinernema feltiae</i> NemaShield®	entomopathogenic nematode	Ok to apply
<i>Stratiolaelaps scimitus</i> (formerly <i>Hypoaspis miles</i>)	predatory mite	Ok to apply
<i>Dalotia (=Atheta) coriaria</i>	predatory beetle	Ok to apply

BotryStop

BotryStop is a live spore preparation of a non-pathogenic saprophytic fungus. When BotryStop spores are applied they germinate and colonize. By occupying the same physical space, BotryStop out-competes pathogens for nutrients in dead and senescing plant tissue. BotryStop provides protection to blossoms, fruit and plant tissue susceptible to *Botrytis cinerea*, *Sclerotinia sclerotiorum* and *Monilinia spp.*

Genus, species	Type	Recommendation
<i>Chrysoperla (=Chrysopa)</i>	predatory lacewing	Ok to apply to adults only
<i>Aphidius colemani</i>	parasitic wasp	Ok to apply
<i>Aphidius ervi</i>	parasitic wasp	Ok to apply

CEASE

CEASE is used for controlling a wide array of both fungal and bacterial pathogens, while providing outstanding plant and environmental safety. Based on a naturally occurring, patented strain of *Bacillus subtilis* (strain QST 713), CEASE can be used as a foliar spray and soil drench on vegetables grown under cover.

Genus, species	Type	Recommendation
<i>Amblyseius (= Neoseiulus) andersoni</i>	predatory mite	Ok to apply
<i>Amblyseius californicus</i>	predatory mite	Ok to apply
<i>Amblyseius cucumeris</i>	predatory mite	OK to apply
<i>Amblyseius swirskii</i>	predatory mite	Ok but some population reduction
<i>Aphelinus abdominalis</i>	parasitic wasp	Ok to apply
<i>Aphidius colemani</i>	parasitic wasp	Ok to apply
<i>Aphidius ervi</i>	parasitic wasp	Ok to apply
<i>Aphidoletes aphidimyza</i>	predatory midge	OK to apply
<i>Bombus spp.</i>	bumblebee	Remove or close hive before application.
<i>Chrysoperla rufilabris</i>	predatory lacewing	Ok to apply
<i>Cryptolaemus montrouzieri</i>	predatory beetle	Ok to apply
<i>Dicyphus hesperus</i>	predatory bug	Ok to apply
<i>Diglyphus isaea</i>	parasitic wasp	Ok to apply
<i>Encarsia formosa</i>	parasitic wasp	Ok to apply
<i>Eretmocerus eremicus</i>	parasitic wasp	Ok to apply
<i>Feltiella acarisuga</i>	predatory midge	Ok to apply
<i>Heterorhabditis bacteriophora</i> NemaShield® HB	entomopathogenic nematode	Ok to apply; Ok to tank mix
<i>Orius insidiosus</i>	predatory bug	Ok to apply
<i>Phytoseiulus persimilis</i>	predatory mite	Ok to apply
<i>Steinernema feltiae</i> NemaShield®	entomopathogenic nematode	Ok to apply
<i>Stratiolaelaps scimitus</i> (formerly <i>Hypoaspis miles</i>)	predatory mite	Ok to apply

MilStop SP

MilStop SP is a water soluble, broad spectrum, foliar fungicide. The active ingredient is potassium bicarbonate and is known to have a detrimental effect on soft bodied insects. Hard bodied insects can be released two days after application.

Refer to product labels for complete application details. Additional technical information is available on our website (bioworksinc.com) or from your BioWorks solutions advisor. Always read and follow label directions.