Greenhouse Insect Pest Management 2026

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Starting and staying clean(er)

Prevention and sanitation are critical in reducing the risk of insect, mite, and disease outbreaks in the greenhouse. Incoming plant material, even if it appears uninfested, is a common way that pests and pathogens are introduced into floriculture production facilities. Ideally, growers should segregate all incoming plugs and liners (particularly vegetatively propagated material) into a clean quarantine area where the new plants can be regularly monitored and, if necessary, treated for an infestation before moving them into the main production area. Prior to transplanting, some growers proactively treat specific kinds of plants for common pests while they are still in plug trays, especially if they intend to finish them in overhead hanging baskets.

Older plants can become reservoirs for pests and pathogens. Operations that maintain stock plants for cuttings should strive to keep insect and mite numbers on these plants as low as possible. Stock plants often develop a dense canopy, which can reduce the penetration and efficacy of spray applications. In such cases, an integrated approach that includes beneficial organisms could prove to be the most effective and resource-efficient option over time.

Weeds can also serve as source of insect pests and diseases. Removing broadleaf weeds from the greenhouse perimeter and indoor production areas will help the operation stay cleaner. Using grass or gravel to cover the area directly *outside* the range and installing weed barrier underneath benches are time-tested methods for keeping broadleaf weed pressure to a minimum.

Cutting dips

Research has shown that any plant material entering the greenhouse is likely to have a small number of pests. Because of this, some floriculture growers dip unrooted cuttings and plugs into reduced-risk pesticides to help lower the number of these hitchhikers. This technique was evaluated by researchers at Canada's Vineland Research & Innovation Centre and has since been adopted by many growers in Ontario. In the United States, there are currently several commercially available products on the market that include labelled uses for dipping:

Insect management products labelled for cutting dip application

Trade name	Active Ingredient	MoA Group	REI (hours)
BotaniGard 22WP	*Beauvaria bassiana*	UNF (insect pathogen)	4
EpiShield*	Botanical oils	Unclassified	0
Hexygon IQ	Hexythiazox	10A (mite growth regulator)	12
Lalguard M52 OD	*Metarhizium brunneum*	UNF (insect pathogen)	4
M-Pede	Potassium salts of fatty acids	Unclassified	12
Mavrik Aquaflow	Tau-fluvalinate	3A (pyrethroid)	12
Romivex*	Botanical oils	Unclassified	0
TetraCURB Max*	Botanical oils	Unclassified	0

Note: Some plants may be sensitive to these treatments (see Phytotoxicity)

Regulatory considerations:

Cutting dips are considered pesticide applications. In practical terms, this means:

- Applicators are required to wear all appropriate label-required personal protective equipment (PPE) when performing cutting dips.
- Employees involved with sticking cuttings immediately following treatment should be trained as Worker Protection Standard (WPS) handlers and be provided PPE as specified on the product label.
- All employees are required to follow label-required restricted-entry interval (REI) specifications for treated areas.

Note that some of these products (*) qualify for exemption from EPA registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and may not carry WPS or Agricultural Use requirement statements. Precautions and Restrictions typically located within the Agricultural Use section, such as those pertaining to PPE and REI, might be detailed under the label's Precautionary Statements.

For more information on WPS training requirements or using cutting dips to treat vegetative cuttings, please contact a member of the Michigan State University Extension Floriculture Team.

Scouting is important

Managing a small population of pests is much easier than managing a large one, particularly when the plant canopy is dense and flowers are present. Regular scouting/monitoring can help growers detect infestations early and prevent damaging outbreaks. Two useful tools for scouting are colored sticky cards and a hand lens. Sticky cards help detect flying/jumping insects in the crop and are particularly useful for monitoring thrips populations. Place one card at canopy level every 2000-4000 ft^2 or at least one per house. Place cards away from where flying biological control agents are being released as these may become trapped as well. Physical inspections of foliage and flowers are important for detecting non-flying pests such as aphids and mites. A hand lens (minimum 10x, suggested 15 – 20X) is used to examine tiny insects and mites and can help confirm pest identification. Digital magnifiers attached to laptop computers or smart phones are also a viable option.

Neonicotinoids

Neonicotinoids are class of insecticides that grew in popularity due to their relatively low mammalian toxicity and ability to move systemically throughout the plant. All neonicotinoid products are in the Mode of Action (MoA) group 4A (see below). Growers with buyers that require neonicotinoid-free plants should look to systemic insecticides in other chemical classes or MoA groups, such as Altus (group 4D), Mainspring (group 28), and Kontos (group 23).

Pyrethroids

Pyrethroids are a class of insecticides with a molecular structure similar to pyrethrins, which are natural compounds produced by some *Chrysanthemum* species. Like neonicotinoids, pyrethroids are used extensively throughout the world because of their broad-spectrum insecticidal activity and negligible toxicity to humans and other mammals. Due to documented resistance issues in all major greenhouse floriculture pest groups and incompatibility with many biological control agents, we no longer recommend pyrethroids as a primary insect management tool. Nevertheless, they still provide some usefulness in rotation and, with few exceptions, have an established record of plant safety (low risk for phytotoxicity). All pyrethroids and pyrethrin products are in the MoA Group 3A (see below).

Biopesticides

Biopesticides are pest management products derived from natural materials, including plants, animals, microbes, and minerals. Interest in their use continues to grow among greenhouse floriculture producers due to resistance management concerns, reduced residues, consumer preferences, and generally shorter re-entry intervals (REI) compared to conventional insecticides.

Although biopesticides can be effective tools, they require a different approach than traditional chemistries. They are most effective when used preventatively, when pest populations are low. Success depends on consistent scouting, proper timing, and an understanding of how the product interacts with the target pest.

Many biopesticides, particularly microbial products, have specific handling and application requirements. Some biopesticides contain living organisms and must be stored and applied carefully to maintain their viability. Excessive heat, incompatible application equipment, or improper application methods can reduce efficacy. For example, high temperatures generated by some foggers can kill microbial products and fine sprayer screens may prevent beneficial nematodes from exiting the nozzle.

When used correctly, biopesticides offer several advantages. They are generally safer for workers, less disruptive to biological control agents, and less persistent in the environment. They also provide additional modes of action that can be rotated with conventional insecticides to help delay resistance.

Biopesticides are not a silver bullet. They typically provide limited residual activity and slower pest mortality, making them a poor choice under high pest pressure. In outbreak situations, a conventional insecticide with strong knockdown may be needed first, followed by biopesticides as part of a robust IPM program.

Resistance Management

Repeated use of products with the same Mode of Action over an extended period of time increases the likelihood that pest populations will become less susceptible to those products (see pyrethroids). To delay or prevent pesticide resistance, avoid using insecticides unless it is necessary. For persistent pest populations on long-term crops (e.g. foliage), consider a rotation schedule of products with a minimum of 3 (more is better) different MoA groups. The MoA class is clearly noted on most labels and also published by the Insecticide Resistance Action Committee (IRAC).

Phytotoxicity

Manufacturers typically test their products on a broad range of plants. They cannot, however, test every ornamental species, variety, tank mix combination, and situation.

Before applying a product to a crop for the first time, you should:

- Consult the label for crop tolerance considerations.
- Test the product at the desired rate on a small number of plants and observe for possible sensitivity over a week or two. Be sure plants are well-watered and not under moisture stress when treated.

If mixing the product with adjuvants or other products for the first time, you should:

- Consult for label for tank-mix compatibility notes.
- Test the product at the desired rate on a small number of plants as described above.

Insecticide products for key greenhouse pests:

Thrips

Trade name	Active ingredient	MoA Group	REI (hours)
Aria	Flonicamid	29	12
Avid	Abamectin	6	12
Azatin, Molt-X, Aza-Direct, others[1]	Azadirachtin	Unknown	4-12**
BotaniGard 22WP/ES, Velifer	*Beauveria bassiana*	UNF	4, 12
Conserve	Spinosad	5	4
Enstar AQ	S-Kinoprene	7A	4
Hachi-Hachi SC	Tolfenpyrad	21A	12
Isarid, NoFly, Ancora	*Isaria fumosorosea*	UNF	4
LALGUARD M52 OD	Metarhizium brunneum	UNF	4
M-Pede / Kopa	Potassium salts of fatty acids	Unclassified	12
Mainspring GNL	Cyantraniliprole	28	4
Nemasys, others	*Steinernema feltiae*	Unclassified	
Orthene	Acephate	1B	12-24
Overture	Pyridalyl	Unknown	12
Pedestal	Novaluron	15	12
Pradia	Cyclaniliprole + Flonicamid	28+29	12
Pylon	Chlorfenapyr	13	12
Safari	Dinotefuran	4A	12
Sirocco	Abamectin + Bifenazate	6 + 20D	12
Suffoil-X, TriTek, Ultra-fine, others	Mineral oil	UNM	4
Tristar	Acetamiprid	4A	12
XXpire	Spinetoram + Sulfoxaflor	5 + 4C	12

Spider Mites

Trade name	Active ingredient	MoA Group	REI (hours)
Akari	Fenpyroximate	21A	12
Botanigard, Velifer	*Beauveria bassiana*	UNF	4, 12
Engulf / Floramite	Bifenazate	20D	12
Hexygon IQ	Hexythiazox	10A	12
LALGUARD M52	*Metarhizium brunneum*	UNF	4
M-Pede / Kopa	Potassium salts of fatty acids	Unclassified	12
Magus	Fenazaquin	21A	12
NoFly, Ancora	*Cordyceps (Isaria) fumosorosea*	UNF	4
Notavo	Clofentazine	10A	12
Pylon	Chlorfenapyr	13	12
Sanmite	Pyridaben	21A	12
Savate	Spiromesifen	23	12
Shuttle-O	Acequinocyl	20B	12
Sirocco	Abamectin + Bifenazate	6 + 20D	12
Suffoil-X, TriTek, Ultra-fine, others	Mineral oils	UNM	4
Sultan	Cyflumetofen	25	12
TetraSan	Etoxazole	10B	12
Triact 70	Neem oil	UNE	4

Aphids

Trade name	Active Ingredient	MoA Group	REI (hours)
Acelepryn	Chlorantraniliprole	28	4
Altus	Flupyradifurone	4D	4
Aria	Flonicamid	29	12
Avid	Abamectin	6	12
Azatin, Molt-X, Aza-Direct, others[1]	Azadirachtin	Unknown	4-12**
BotaniGard 22WP/ES, Velifer	*Beauveria bassiana*	UNF	4, 12
Endeavor	Pymetrozine	9B	12
Enstar AQ	s-Kinoprene	7A	4
Flagship	Thiamethoxam	4A	12
Hachi-Hachi SC	Tolfenpyrad	21A	12
Isarid, NoFly WP, Ancora,	*Cordyceps (Isaria) fumosorosea*	UNF	4
Kontos	Spirotetramat	23	24
LALGUARD M52 OD	*Metarhizium brunneum*	UNF	4
M-Pede / Kopa	Potassium salts of fatty acids	Unclassified	12
Mainspring GNL	Cyantraniliprole	28	4
Marathon, Mantra, Benefit, others	Imidacloprid	12	4A
Orthene	Acephate	1B	12-24
Pradia	Cyclaniliprole + Flonicamid	28+29	12
Rycar	Pyrifluquinazon	9B	12
Safari	Dinotefuran	4A	12
Sarisa	Cycaniliprole	28	4
Sirocco	Abamectin + Bifenazate	6 + 20D	12
Suffoil-X, TriTek, Ultra-fine, others	Mineral oil	UNE	4
Talstar P	Bifenthrin	3A	12
Triact 70	Neem oil	Unknown	4
TriStar	Acetamiprid	4A	12
Ventigra	Afidopyropen	9D	12
XXpire	Spinetoram + Sulfoxaflor	5 + 4C	12

Fungus gnats

Trade name	Active ingredient	MoA Group	REI (hours)
Adept	Diflubenzuron	15	12
Azatin, Molt-X, Aza-Direct, others[1]	Azadirachtin	Unknown	4-12**
Citation	Cyromazine	17	12
Distance	Pyriproxyfen	7C	12
Enstar AQ	s-Kinoprene	7A	4
Flagship	Thiamethoxam	4A	12
Gnatrol	*Bacillus thuringiensis israelensis* (Bti)	11	4
Marathon, Mantra, Benefit, others	Imidacloprid	4A	12
Nemasys, others	*Steinernema feltiae*	Unclassified	
Safari	Dinotefuran	4A	12
TriStar	Acetamiprid	4A	12

Broad mites

Trade name	Active ingredients	MoA Group	REI (hours)
Akari	Fenpyroximate	21A	12
Avid	Abamectin	6	12
Magus	Fenazaquin	21A	12
Pylon	Chlorfenapyr	13	12
Sanmite	Pyridaben	21A	12
Savate	Spiromesifen	23	12
Sirocco	Abamectin + Bifenazate	6 + 20D	12
Suffoil-X, TriTek, Ultra-Pure, others	Mineral oil	UNM	4

Whiteflies

Trade name	Active ingredient	MoA Group	REI (hours)
Adept	Diflubenzuron	15	12
Altus	Flupyradifurone	4D	4
Aria	Flonicamid	29	12
Avid	Abamectin	6	12
Azatin, Molt-X, Aza-Direct, others[1]	Azadirachtin	Unknown	4-12**
BotaniGard 22WP/ES, Velifer	*Beauveria bassiana*	UNF	4
Distance (not for Q biotype)	Pyriproxyfen	7C	12
Endeavor	Pymetrozine	9B	12
Enstar AQ (not for Q biotype)	s-Kinoprene	7A	4
Flagship	Thiamethoxam	4A	12
Hachi-Hachi SC	Tolfenpyrad	21A	12
Isarid, NoFly, Ancora	*Cordyceps (Isaria) fumosorosea*	UNF	4
Kontos	Spirotetramat	23	24
LALGUARD M52 OD	*Metarhizium brunneum*	UNF	4
M-Pede / Kopa	Potassium salts of fatty acids	Unclassified	12
Magus	Fenazaquin	21A	12
Mainspring GNL	Cyantraniliprole	28	4
Marathon, Benefit, Mantra, others	Imidacloprid	4A	12
Orthene	Acephate	1B	12-24
Pedestal	Novaluron	15	12
Pradia	Cyclaniliprole + Flonicamid	28+29	12
Preclude	Fenoxycarb	7B	12
Rycar	Pyrifluquinazon	9B	12
Safari	Dinotefuran	4A	12
Sanmite	Pyridaben	21A	12
Savate	Spiromesifen	23	12
Sirocco	Abamectin + Bifenazate	6 + 20D	12
Suffoil-X, TriTek, Ultra-Pure, others	Mineral oil	UNM	4
Talus (not for Q biotype)	Buprofezin	16	12
Triact 70	Neem oil	UNE	4
TriStar	Acetamiprid	4A	12
Ventigra	Afidopyropen	9D	12

Caterpillars

Trade name	Active ingredients	MoA Group	REI (hours)
Acelepryn	Chlorantraniliprole	28	4
Adept	Diflubenzuron	15	12
Attain	Bifenthrin	3A	12
Avid	Abamectin	6	12
Azatin, Molt-X, Aza-Direct, others[1]	Azadirachtin	Unknown	4-12**
Conserve	Spinosad	5	4
Decathlon	Cyfluthrin	3	12
DiPel, others	*Bacillus thuringiensis kurstaki* (Btk)	11	4
Intrepid 2F	Methoxyfenozide	18	4
M-Pede	Potassium salts of fatty acids	Unclassified	12
Mainspring	Cyantraniliprole	28	4
Mavrik Aquaflow	Tau-fluvalinate	3A	12
Orthene	Acephate	1B	12-24
Overture	Pyridalyl	Unknown	12
Pedestal	Novaluron	15	12
Pradia	Cyclaniliprole + Flonicamid	28+29	12
Pylon	Chlorfenapyr	13	12
Sarisa	Cycaniliprole	28	4
Tame	Fenpropathrin	3	24
TriStar	Acetamiprid	4A	12
XXpire	Spinetoram + Sulfoxaflor	5 + 4C	12

Mealybugs[2]

Trade name	Active ingredients	MoA Group	REI (hours)
Altus	Flupyradifurone	4D	4
Aria	Flonicamid	29	12
Azatin, Molt-X, Aza-Direct, others[1]	Azadirachtin	Unknown	4-12**
BotaniGard, Velifer	*Beauveria bassiana*	UNF	4, 12
Distance	Pyriproxyfen	7C	12
Enstar AQ	s-Kinoprene	7A	4
Flagship	Thiamethoxam	4A	12
Hachi-Hachi	Tolfenpyrad	21A	12
Kontos	Spirotetramat	23	23
LALGUARD M52 OD	Metarhizium brunneum	UNF	4
M-Pede, Kopa	*Potassium salts of fatty acids*	Unclassified	12
Isarid, NoFly, Ancora	*Cordyceps (Isaria) fumosorosea*	UNF	4
Orthene	*Acephate*	1B	12-24
Pradia	Cyclaniloprole + Flonicamid	28+29	12
Rycar	Pyrifluquinazon	9B	12
Safari	Dinotefuran	4A	12
Suffoil-X, TriTek, Ultra-Pure, others	Mineral oils	UNM	4
Talstar	Bifenthrin	3A	12
Talus	Buprofezin	16	12
Triact 70	Neem oil	UNE	4
TriStar	Acetamiprid	4A	12
XXpire	Spinetoram + Sulfoxaflor	5 + 4C	12

MoA = Mode of Action
REI = Restricted Entry Interval
UNE = Botanical essence including synthetic, extracts and unrefined oils with unknown or uncertain MoA
UNF = Fungal agents of unknown or uncertain MoA
UNM = Non-specific mechanical and physical disruptors

[1] Other azadirachtin products include: AzaGuard, Azatrol, AzaSol.

[2] In research trials, foliar spray applications of Safari, Flagship, and Kontos were as effective as drenches at controlling mealybugs. Adding a spreader adjuvant such as CapSil or Silwet improved efficacy.

** Restricted entry intervals vary across azadirachtin products. Please consult the label.

We thank JC Chong of SePRO Corporation for his review of this document.