

Greenhouse Insect Pest Management 2023

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Starting and staying clean(er)

Prevention and sanitation are critical in reducing the risk of insect and disease outbreaks in the greenhouse. Incoming plant material, even if it appears uninfested, is one of the most common ways that insect and mite pests are introduced into floriculture production facilities. Ideally, growers should place all incoming plugs and liners into a quarantine area where they can be regularly monitored and, if necessary, treated for an infestation before moving them into the production area. Operations that maintain stock plants for cuttings should strive to keep insect and mite numbers on the stock plants as low as possible. Stock plants often develop a thick canopy, which can reduce the penetration and efficacy of spray applications. In such cases, an integrated approach using beneficial organisms could prove to be the most effective and resource-efficient option over time.

Scouting is important

Managing a small population of pests is much easier than managing a large one. Regular scouting/monitoring can help growers detect infestations early and prevent damaging outbreaks. The two most useful tools for scouting are the yellow sticky card and the hand lens. Sticky cards provide a snapshot of all the flying/jumping insects in the crop and are the ideal tool for monitoring thrips populations. Place one card at canopy level every 2000-4000 ft² or at least one per house. Physical inspections of foliage and flowers are required to detect non-flying pests such as aphids and mites. A hand lens is used to examine tiny insects and mites and can help confirm pest identification.

Neonicotinoids

Neonicotinoids are a 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. They still, however, provide some usefulness in rotation or in a tank-mix with other insecticide products. All pyrethroids and pyrethrin products are in the Mode of Action Group 3A (see below).

Resistance Management

Repeated use of products with the same MoA over an extended period of time will create pest populations that are less susceptible to those products (see pyrethroids). To delay or prevent pesticide resistance, growers should develop a rotation schedule of products with a minimum of 3 different Mode of Action (MoA) groups (more is better). Mode of Action classification of products are published by the Insecticide Resistance Action Committee (IRAC) with the goal of prolonging the effectiveness of insecticides and miticides.

More information on IRAC and Mode of Action: <https://irac-online.org/mode-of-action/>

Phytotoxicity

Manufacturers typically test their products on a broad range of plants. They cannot, however, test a product for compatibility with every ornamental species and variety.

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.

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.

Insecticide products for key greenhouse pests:

Thrips			
Trade name	Active ingredient	MoA Group	REI (hours)
Aria	Flonicamid	29	12
Azatin, Molt-X, Aza-Direct, others ¹	Azadirachtin	Unknown	4-12**
BotaniGard 22WP, Velifer	<i>Beauveria bassiana</i>	Fungus	4, 12
Conserve	Spinosad	5	4
Hachi-Hachi SC	Tolfenpyrad	21A	12
Mainspring GNL	Cyantraniliprole	28	4
Ancora, NoFly	<i>Isaria fumosoroseus</i>	Fungus	4
Orthene 97	Acephate	1B	12-24
Overture	Pyridalyl	Unknown	12
Pedestal	Novaluron	15	12
Pradia	Cyclaniloprole + Flonicamid	28+29	12
Pylon	Chlorfenapyr	13	12
Safari	Dinotefuran	4A	12
Tristar	Acetamiprid	4A	12
XXpire	Spinetoram + Sulfoxaflor	5 + 4C	12

Spider mites			
Trade name	Active ingredient	MoA Group	REI (hours)
Akari	Fenpyroximate	21A	12
Avid	Abamectin	6	12
Engulf / Floramite	Bifenazate	20D	12
Hexygon	Hexythiazox	10A	12
Kopa / M-Pede	Insecticidal soaps	Unclassified	12
Magus	Fenazaquin	21A	12
Notavo	Clofentazine	10A	12
Pylon	Chlorfenapyr	13	12
Sanmite	Pyridaben	21A	12
Savate	Spiromesifen	23	12
Shuttle-O	Acequinocyl	20B	12
Suffoil-X, TriTek, Ultra-Pure, others	Horticultural oils	UNM	4
Sultan	Cyflumetofen	25	12
Tetrasan	Etoxazole	10B	12

Aphids			
Trade name	Active Ingredient	MoA Group	REI (hours)
Acelepryn	Chlorantraniliprole	28	4
Altus	Flupyradifurone	4D	4
Aria	Fonicamid	29	12
Azatin, Molt-X, Aza-Direct, others ¹	Azadirachtin	Unknown	4-12**
BotaniGard 22WP, 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
Kontos	Spirotetramat	23	24
Kopa / M-Pede	Insecticidal soaps	Unclassified	12
Mainspring GNL	Cyantraniliprole	28	4
Marathon, Benefit, Mantra, others	Imidacloprid	12	4A
Ancora, NoFly	<i>Isaria fumosoroseus</i>	UNF	4
Orthene 97	Acephate	1B	12-24
Pradia	Cyclaniloprole + Fonicamid	28+29	12
Rycar	Pyrifluquinazon	9B	12
Safari	Dinotefuran	4A	12
Suffoil-X, TriTek, Ultra-Pure, others	Horticultural oils	UNM	4
Talstar	Bifenthrin	3A	12
Tristar	Acetamiprid	4A	12
Ventigra	Afidopyropen	9D	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
Suffoil-X, TriTek, Ultra-Pure, others	Horticultural oils	UNM	4

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	<i>Bacillus thuringiensis israelensis (Bti)</i>	11	4
Marathon, Benefit, Mantra, others	Imidacloprid	4A	12
Nemasys, others	<i>Steinernema feltiae</i>	Unclassified	
Safari	Dinotefuran	4A	12

Whiteflies			
Trade name	Active ingredient	MoA Group	REI (hours)
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, Velifer	<i>Beauveria bassiana</i>	Fungus	4
Distance (not for Q biotype)	Pyriproxyfen	7C	12
Enstar AQ (not for Q biotype)	s-Kinoprene	7A	4
Flagship	Thiamethoxam	4A	12
Hachi-Hachi SC	Tolfenpyrad	21A	12
Kontos	Spirotetramat	23	24
Kopa / M-Pede	Insecticidal soaps	Unclassified	12
Mainspring GNL	Cyantraniliprole	28	4
Marathon, Benefit, Mantra, others	Imidacloprid	4A	12
Orthene 97	Acephate	1B	12-24
Pedestal	Novaluron	15	12
Pradia	Cyclaniloprole + Flonicamid	28+29	12
Rycar	Pyrifluquinazon	9B	12
Safari	Dinotefuran	4A	12
Sanmite	Pyridaben	21A	12
Sarisa	Cycaniliprole	28	4
Savate	Spiromesifen	23	12
Suffoil-X, TriTek, Ultra-Pure, others	Horticultural oils	UNM	4
Talus (not for Q biotype)	Buprofezin	16	12
Tristar	Acetamiprid	4A	12
Ventigra	Afidopyropen	9D	12
XXpire	Spinetoram + Sulfoxaflor	5 + 4C	12

Mealybugs²			
Trade name	Active ingredients	MoA Group	REI (hours)
Aria	Flonicamid	29	12
Distance	Pyriproxyfen	7C	12
Enstar AQ	s-Kinoprene	7A	4
Flagship	Thiamethoxam	4A	12
Kontos	Spirotetramat	23	23
Orthene 97	Acephate	1B	12-24
Pradia	Cyclaniloprole + Flonicamid	28+29	12
Rycar	Pyrifluquinazon	9B	12
Safari	Dinotefuran	4A	12
Suffoil-X, TriTek, Ultra-Pure, others	Horticultural oils	UNM	4
Talstar	Bifenthrin	3A	12
Talus	Buprofezin	16	12
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
Avid	Abamectin	6	12
Dipel	<i>Bacillus thuringiensis kurstaki (Btk)</i>	11	4
Conserve	Spinosad	5	4
Mainspring	Cyantraniliprole	28	4
Orthene 97	Acephate	1B	12-24
Overture	Pyridalyl	Unknown	12
Pedestal	Novaluron	15	12
Pradia	Cyclaniloprole + Flonicamid	28+29	12
Pylon	Chlorfenapyr	13	12
Sarisa	Cycaniliprole	28	4
Xxpire	Spinetoram + Sulfoxaflor	5 + 4C	12

MoA = Mode of Action

REI = Restricted Entry Interval

UNM = Non-specific mechanical and physical disruptors

¹ Other azadirachtin products include: AzaGuard, Azatrol, AzaSol, Ornazin

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 resulted in improved efficacy.

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

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