

Miticides for Use in Greenhouse Production Systems

Question: Could you provide background information associated with the different miticides commercially available for use in greenhouse production systems against the twospotted spider mite?



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Answer: It will be my pleasure. A wide range of miticides can be used in greenhouse production systems to mitigate problems with the twospotted spider mite, *Tetranychus urticae*, which is the most commonly encountered mite pest of greenhouse-grown horticultural crops. A listing of the commercially available miticides is presented in Table 1. However, let's discuss these miticides in detail. First and foremost, not all the miticides have activity on all the life stages of the twospotted spider mite; some are active on the later life stages (e.g., nymphs and adults) whereas others are active on the early life stages (e.g., eggs and larvae). This information is available in Table 1.

Now we will discuss activity type. Eight miticides only have contact activity including: acequinocyl (Shuttle), bifenazate (Floramite), clofentezine (Notavo), cyflumetofen (Sultan), fenazaquin (Magus), fenpyroximate (Akari), hexythiazox (Hexygon)

and pyridaben (Sanmite); so thorough coverage of leaf undersides is critical because this is where all the life stages (eggs, larvae, nymphs and adults) are typically located. Seven miticides have translaminar or local systemic activity, such as abamectin (Avid), abamectin + bifenazate (Sirocco), chlorfenapyr (Pylon), etoxazole (TetraSan), spiromesifen (Savate) and spirotetramat (Kontos).

These miticides penetrate leaf tissues and form a reservoir of active ingredient within the leaf. Consequently, this provides residual activity against spider mites after leaf surface residues have dissipated. Spirotetramat (Kontos) is the only miticide with systemic properties. However, due to the low water solubility (29 ppm or mg/L), the miticide must be applied at least four weeks before spider mites are present.

What is important to understand is that although there are 14 different miticides, there are only seven different modes of action (refer to the last column of Table 1). For instance, seven of the miticides are mitochondria electron transport inhibitors (METI)



Feeding damage caused by twospotted spider mite, *Tetranychus urticae*.


Active Ingredient	Trade Name	Activity Type	Egg	Larva	Nymph	Adult	Mode of Action and Insecticide Resistance Action Committee or IRAC Designation (In Parentheses)
Abamectin	Avid	C and T		X	X	X	GABA* Chloride Channel Activator (6)
Abamectin + Bifenazate	Sirocco	C and T	X	X	X	X	GABA Chloride Channel Activator + Mitochondria Electron Transport Inhibitor (6 + 20D)
Acequinocyl	Shuttle	C	X	X	X	X	Mitochondria Electron Transport Inhibitor (20B)
Bifenazate	Floramite	C	X	X	X	X	Mitochondria Electron Transport Inhibitor (20D)
Chlorfenapyr	Pylon	C and T		X	X	X	Oxidative Phosphorylation Uncoupler (13)
Clofentezine	Notavo	C	X	X	X		Growth and Embryogenesis Inhibitor (10A)
Cyflumetofen	Sultan	C	X	X	X	X	Mitochondria Electron Transport Inhibitor (25)
Etoxazole	TetraSan	C and T	X	X	X		Chitin Synthesis Inhibitor (10B)
Fenazaquin	Magus	C	X	X	X	X	Mitochondria Electron Transport Inhibitor (21A)
Fenpyroximate	Akari	C	X	X	X	X	Mitochondria Electron Transport Inhibitor (21A)
Hexythiazox	Hexygon	C	X	X	X		Growth and Embryogenesis Inhibitor (10A)
Pyridaben	Sanmite	C	X	X	X	X	Mitochondria Electron Transport Inhibitor (21A)
Spiromesifen	Savate	C and T	X	X	X		Lipid Biosynthesis Inhibitor (23)
Spirotetramat	Kontos	C, T, and S	X	X	X		Lipid Biosynthesis Inhibitor (23)

Activity Type Codes: C=Contact, T=Translaminar, and S=Systemic
 * GABA=gamma-aminobutyric acid (neurotransmitter)

Table 1. Miticides (active ingredient and trade name) and their targeted twospotted spider mite (*Tetranychus urticae*) life stages, and description of mode of action.

including abamectin + bifenazate (Sirocco), acequinocyl (Shuttle), bifenazate (Floramite), cyflumetofen (Sultan), fenazaquin (Magus), fenpyroximate (Akari) and pyridaben (Sanmite). Two miticides are lipid biosynthesis inhibitors [spiromesifen (Savate) and spirotetramat (Kontos)] and two are growth and embryogenesis inhibitors [clofentezine (Notavo) and hexythiazox (Hexygon)]. Abamectin (Avid), chlorfenapyr (Pylon) and etoxazole (TetraSan) have different modes of action from the other miticides (Table 1).

It is important to know the mode of action of all of these miticides to avoid applying miticides

in succession with similar modes of action so as to prevent twospotted spider mite populations from developing resistance. A description of the mode of action and the IRAC (Insecticide Resistance Action Committee) mode of action designation is presented in the last column of Table 1. This information will assist you in developing appropriate rotation programs against twospotted spider mite populations. Remember to use a miticide with the same mode of action within a generation, and then switch to miticide with a different mode of action in the next generation. 

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