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New Tools Available for Spider Mite Management in 2006

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During the past few years the number of miticides registered for California crops has increased dramatically. These products represent not only new formulations of existing products, but also completely new active ingredients and modes of action. These new miticides are also considered relatively reduced-risk with many offering shorter re-entry and pre-harvest intervals than most existing products. New miticide registrations also greatly enhance our ability to use rotation of materials as a viable strategy for the management of resistance.

Table 1 lists the predominant miticides used in California crops. Relatively new members of this list include Acramite, Desperado, Fujimite, Kanemite, Oberon, Onager and Zeal. Some of these products contain active ingredients that were previously available (i.e., Desperado is the active ingredient of Nexter plus sulfur whereas Onager is an EC formulation of the active ingredient of Savey) and others offer completely new active ingredients and modes of action.

Each of these new miticides has something to offer to mite management in California; the trick is to figuring out which miticide will work best under which situation, and to determine how to best fit them into resistance management plans and the economics of the crop. In some cases research is readily available to document the effects of these products, and in other cases our knowledge of the best fit of these products is still in its infancy.

Despite new miticides, IPM is still the Key

While the new miticides offer new options in managing mites, the backbone of any integrated pest management program should always be monitoring, proper identification and rational action thresholds. Most species of spider mites thrive under hot, dry conditions, especially when leaves become dusty and cultural practices to mitigate these conditions should be the first line of defense. Dusty conditions can be avoided by managing road surfaces with water, oils or other dust-reducing products as well as by driving slower.

Plant stress is another common cause of mite flareups. This stress can be accidental as a the result of improper fertilization or inadequate irrigation, or can be a planned yearly phenomenon for crops like almonds, winegrapes, or early-harvested navel oranges where backing off of water is part of standard harvest preparations. The key to managing mites in these situations is to promote biological control early so that it is in place by the end of the season when temperatures rise and plant stress increases. If cultural and biological controls are insufficient, then miticides may be warranted.

In most California crops, predatory mites, thrips, small hemipterans (such as minute pirate bugs), and some ladybird beetles are the backbone of biological control. In most cases, however, information is not yet available on the effects of miticides on each of these predators. Until this has been developed, it would be beneficial for all growers using these products to keep track of the populations of these predators not only before applications

(when determining the need to spray or not), but also afterwards to learn how they influence biocontrol as part of a comprehensive IPM program.

Resistance management

One of the biggest potential winners with the recent registration of so many miticides is resistance management. Tables 1 and 2 both list the mode of action number, as designated the Insecticide Resistance Action Committee (IRAC) for each of the most common miticides in California. In the tables, any two miticides with the same IRAC number are considered to have the same mode of action and should not be used back to back during the same season.

Table 2 also includes a brief description of how each miticide works. This is important because different miticides work in different ways and on different life stages. For example, a PCA needs to know that a mite growth regulator that inhibits molting will not immediately kill adults or eggs just as a product that causes adults to produce sterile eggs may have little effect on the juvenile mite stages. Additionally, one would expect that each of these products will work completely differently that a miticide with strictly contact activity. Because of details like these it is important to know the modes of action when deciding which miticide is needed (in cases where one is needed at all), as well as understanding observations made during follow-up visits to the field.

Conclusion

The recent registration of several new reduced-risk miticides, some of which represent completely new modes of action, should be considered a great opportunity and challenge for anybody battling mites. It is now up to us as Growers, Pest Control Advisors, UC Extension and Chemical Company Representatives to become good stewards of the products. The trick will be to figure out how to use these products to enhance our IPM programs, and to avoid increased reliance on miticides at the expense of ever-important cultural and biological controls.

Table of Some of the Most Common Miticides for Use Against Spider Mites[1] in California (Version 1, Nov. 2005)[2]

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Miticide	Active Ingredient	Producer	Targeted life stages and mode of action	IRAC Number[3]
Acramite	bifenazate	Chemtura	contact toxin on all stages by unknown mechanism in nervous system	25
Agri-Mek	abamectin	Syngenta	contact or ingestion toxin that paralyzes juveniles and adults; death by starvation	6
Apollo	clofentezine	Makht.-Agan	growth regulator of mite eggs and some nymphs	10A
Carzol	formetanate	Gowan	contact toxin that inhibits acetylcholinesterase (carbamate)	1A
Comite	propargite	Chemtura	contact on juveniles and adults by inhibition of ATP synthesis	12C
Danitol	fenpropathrin	Valent	nerve toxin to juveniles and adults by modification of sodium channels (pyrethroid)	3
Desperado	pyridaben/sulfur	BASF	contact on juveniles and adults by inhibition of energy production, plus sulfur	21
Dicofol	dicofol	multiple	contact toxin of juveniles and adults with unknown mode of action	UNC
Envidor	spirodiclofen	Bayer	contact on all mite stages by inhibiting lipid biosynthesis; most effective on juveniles	23
Fujimite	fenpyroximate	Nichino	contact toxin to eggs, juveniles and adults; inhibits electron transport in the mitochondria	21
Kanemite	acequinocyl	Arysta	contact toxin to eggs, juveniles and adults; inhibits electron transport in the mitochondria	20B
Kelthane	dicofol	Dow	contact toxin of juveniles and adults with unknown mode of action	UNC
Nexter	pyridaben	BASF	contact on juveniles and adults by inhibition of energy production	21
Oberon	spiromesifen	Bayer	contact on all mite stages by inhibiting lipid biosynthesis; most effective on juveniles	23
Omite	propargite	Chemtura	contact on juveniles and adults by inhibition of ATP synthesis	12C
Onager	hexythiazox	Gowan	mite growth regulator; adult females lay sterile eggs; contact toxin on eggs and juveniles	10A
Savey	hexythiazox	Gowan	mite growth regulator; adult females lay sterile eggs; contact toxin on eggs and juveniles	10A
Vendex	fenbutin-oxide	Du Pont	contact toxin to juveniles and adults by inhibition of ATP synthesis	12B
Zeal	etoxazole	Valent	contact toxin on eggs; inhibits molting of juveniles; adult females produce sterile eggs	10B
Zephyr	abamectin	Syngenta	contact or ingestion toxin that paralyzes juveniles and adults; death by starvation	6

[1] Spider mite species include *Tetranychus* spp. (Pacific, two-spotted, strawberry, McDaniel, Carmine spider mites), *Panonychus* spp. (European, citrus red mites), *Eotetranychus* spp. (Willamette, Yuma spider mites), *Eutetranychus banksi* (Texas citrus mite)

[2] Pesticide-related information is always changing. To recommend changes to the table please contact David Haviland. dhaviland@ucdavis.edu, 661 868-6215

[3] Insecticide Resistance Action Committee (IRAC) numbers used to denote different modes of action. Same number indicates same mode of action

Registration Status of Selected Miticides for Use Against Spider Mites[1] in California. (Current as of January, 2006)

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Key: YES = fully registered for use NB = registered for use on non-bearing crops only No = not registered for use

	IRAC	Nut Crops			Stone Fruits					Citrus	Pome Fruits		Grape	Cotton
	Number[2]	Almond	Pistachio	Walnut	Apricot	Cherry	Peach	Plum	Nectarine		Apple	Pear		
Acramite	25	YES	YES	YES	NB	NB	YES	YES	YES	NB	YES	YES	YES	YES
Agri-Mek	6	YES	no	YES	no	no	no	YES	no	YES	YES	YES	YES	no
Apollo	10A	YES	no	YES	YES	YES	YES	no	YES	no	YES	YES	YES	no
Carzol	1A	no	no	no	no	no	YES	no	YES	No[3]	YES	YES	no	no
Comite	12C	no	no	no	no	no	no	no	no	no	no	no	no	YES
Danitol	3	no	no	no	no	no	no	no	no	YES	YES	No[3]	No[3]	No[3]
Desperado	21	YES	YES	YES	no	no	YES	YES	YES	no	no	no	no	no
Dicofol	UNC	no	no	YES	no	no	no	no	no	YES	YES	YES	YES	YES
Envidor	23	no	no	no	no	no	no	no	no	no	no	no	no	no
Fujimite	21	NB	NB	NB	NB	NB	NB	NB	NB	no	YES	YES	YES	YES
Kanemite	20B	YES	YES	no	no	no	no	no	no	YES	YES	YES	no	no
Kelthane	UNC	no	no	YES	no	no	no	no	no	YES	YES	YES	YES	YES
Nexter	21	YES	YES	YES	no	no	YES	YES	YES	YES	YES	YES	YES	no
Oberon	23	no	no	no	no	no	no	no	no	no	no	no	no	YES
Omite	12C	YES	NB	YES	NB	YES[4]	NB	NB	YES	YES[5]	NB	NB	YES	no
Onager	10A	YES	YES	YES	YES	YES	YES	YES	YES	NB	no	no	NB	YES
Savey	10A	YES	YES	YES	YES	YES	YES	YES	YES	NB	YES	YES	NB	no
Vendex	12B	YES	no	YES	no	YES	YES	YES	YES	YES	YES	YES	YES	no
Zeal	10B	YES	YES	YES	NB	NB	NB	NB	NB	NB	YES	YES	YES	YES
Zephyr	6	no	no	no	no	no	no	no	no	no	no	no	no	YES

[1] Spider mite species include *Tetranychus* spp. (pacific, two-spotted, strawberry, McDaniel, Carmine spider mites), *Panonychus* spp. (European, citrus red mites), *Eotetranychus* spp. (Willamette, Yuma spider mites), *Eutetranychus banksi* (Texas citrus mite)

[2] Insecticide Resistance Action Committee (IRAC) numbers used to denote different modes of action. Same number indicates same mode of action

[3] Miticide is registered for the crop, but one or more spider mites are not listed on the label as target pests

[4] For use on non-bearing, or post-harvest on bearing

[5] For use on any non-bearing, or post-harvest on bearing navels or grapefruit