

New Insecticides for Desert Produce and Melons

John C. Palumbo, Yuma Ag Center

Over the past 20 years, there has been an unprecedented development of insecticide chemistry that has resulted in the registration of a number of key products in desert crops. Among these were several breakthrough chemistries that have had a major impact on how PCAs manage insects on leafy vegetables and melons. The first important chemical class developed was the neonicotinoids with the registration of imidacloprid (Admire 2F) in 1993. It was the first selective, systemic insecticide developed for whiteflies and aphids. Since then a number of other neocotinoid compounds have been registered (acetamiprid, thiamthozam, acetamiprid, clothianidin). The second major breakthrough chemistry to be developed for desert crops were the spinosyns lead by the registration of Success/Entrust in 1997 and followed most recently with Radiant in 2008. The spinosyns were one of the first Reduced-risk chemistries developed, and have excellent activity against both Lep larvae and thrips. This was followed by the Ketoenols (Tetramic acid derivatives) with the registration of Oberon in 2003 and Movento in 2008, of which Movento was the first fully systemic insecticide to adequately control whiteflies and aphids via foliar application. Finally, the diamide chemistry was developed most recently and provided two active ingredients, rynaxypry and flubendiamide that provided activity against chewing insects via foliar sprays, and for the first time, activity through soil, systemic activity. There have also been a number of other key chemistries that play a key role in desert IPM programs with products such as Courier, Knack, Beleaf, Intrepid, Proclaim and others. Without question though, the products now available for use in desert vegetable crops are more effective and safer to use than compounds used prior to 1993.

In 2014, several new insecticide products became available for management of the key pest found on desert crops. Sequoia (*Sulfoxaflo*r) and Torac (tolfenpyrad) were registered for use in leafy vegetables and melons last spring, and Exirel/Verimark (*Cyazypyr*) received registration this past August. Sivanto (*flupyradifurone*) is anticipated to be available in early 2015. At the Yuma Agricultural Center (YAC) we have been working with these compounds for the past 5-6 years to understand their insecticidal activity and best fit in local IPM programs once they hit the market. Below, information is provided on each of these compounds with a description of their route of activity, MOA, effective spectrum and rates and Key Desert Fit. Furthermore, we provide an Index of Efficacy for each compound that ranks their comparative efficacy against the local standards. These ranking were derived from evaluations in multiple field trials and applications conducted at YAC. The product was given an A if it showed consistently good control comparable to the industry standard; a B when inconsistent control was measured relative to the local standard, and a C when its activity was not economically effective (consistently poor control relative to the standard and untreated check). Finally a summary of the attributes and activity for each compound is provided.

Sequoia (*sulfoxaflo*r)

Chemistry:	Sulfoxamine
IRAC Mode of Action:	Group 4C, Nicotinic AChR agonist
Route of Activity:	Foliar contact; translaminar; xylem mobile
Effective Spectrum:	Aphids, Lygus spp., Whitefly
Recommended Rates:	Aphids, 2.0 oz ; Whiteflies, 4.5-5.7 oz
Key Desert Fit:	Foliar alternative for aphids in leafy vegetable Rotational alternative for whitefly in melons

Pest	No. Trials	No. Applications	IPM Standard	Comparative Efficacy
Aphids	18	39	Movento, Neonicotinoids	A
Whiteflies	16	38	Movento, Neonicotinoids	A-B
Begrada Bug	5	8	Pyrethroid, Lannate	B
Thrips	2	6	Radiant, Lannate	C

A	Excellent activity; As good as the standard
B	Inconsistent activity; Not as good as the standard
C	Not economically effective

Sequoia (*Sulfoxaflo*r) is currently registered for use on leafy vegetables and melons in Arizona. Although it has a similar target site as the neonicotinoid, it is not considered a neonicotinoid by IRAC because of differences in how insects metabolize the toxin. Rather, it is classified as a sulfoximine and the first of the chemical class to be registered. It has excellent activity against most aphids found on leafy vegetables through both contact (rapid knockdown) and ingestion (14-21 d residual control). Control can be achieved at low label rates, however, control of lettuce aphid may require higher rates. It also has activity against Lygus spp., but has shown inconsistent activity against the Begrada bug. It has adult whitefly knockdown activity at higher rates comparable to some neonicotinoids in melons, but has shown less residual control of nymphs. Finally, Sequoia does not appear to have economic activity against western flower thrips. Sequoia should be a great addition to local vegetable IPM programs. Like most new products it is toxic to bees exposed to direct contact, but much safer after spray residues have dried on foliage. Care should be taken when applying Sequoia on melons when plants are in bloom.

Sivanto (*flupyradifurone*)

Chemistry:	Butenolide
IRAC Mode of Action:	Group 4D, Nicotinic AChR agonist
Route of Activity:	Foliar -contact/translaminar; Soil - systemic, xylem mobile
Effective Spectrum:	Aphids, Whitefly
Recommended Rates:	Foliar, 10 oz ; Soil, 28 oz
Key Desert Fit:	Soil alternative for whiteflies/CYSD in melons Foliar alternative for whitefly in leafy vegetables

Pest	No. Trials	No. Applications	IPM Standard	Comparative Efficacy
Whiteflies-Foliar	17	40	Movento, Neonicotinoids	A
Whiteflies-Soil	15	15	Neonicotinoids	A
Aphids-Foliar	10	18	Movento, Sequoia	B
Aphids-Soil	4	4	Imidacloprid	B
Bagrada Bug	4	8	Pyrethroids, Lannate	B-C
Thrips	3	6	Radiant, Lannate	C

A	Excellent activity; As good as the standard
B	Inconsistent activity; Not as good as the standard
C	Not economically effective

Sivanto (*flupyradifurone*) is not currently registered for use in Arizona. A registration is expected sometime in early 2015. Sivanto is also not a neonicotinoid, but rather is considered a Butenolide. It has good activity against whiteflies as both a foliar spray and as a soil-applied systemic treatment. As a soil systemic in fall melons, it has shown to be very effective against adult whitefly and CYSDV suppression similar to Venom. This is presumably due to rapid feeding cessation by adults once they ingest the product. As a foliar spray against whiteflies it has shown quick knockdown and residual as good as or better than most neonicotinoids. Activity against aphids has been inconsistent, where it has good knockdown (7-10 days), but less consistent residual control than either Movento or Sequoia. It is weak against Bagrada bug and thrips. It appears to be very safe product and has been grant reduced-risk status by the USEPA. Based on the manufactures data, Sivanto has shown minimal toxicity to bees under direct contact conditions.

Exirel / Verimark (cyazypyr)

Chemistry:	Anthranilic diamide
IRAC Mode of Action:	Group 28, Ryanodine receptor agonist
Route of Activity:	Foliar- contact/translaminar; Soil - systemic, xylem mobile
Effective Spectrum:	Leps, Whiteflies, Leafminers
Recommended Rates:	Foliar, 14-20 oz ; Soil, 10-14 oz
Key Desert Fit:	Soil or Foliar alternative for whiteflies, Leps, and leafminers in produce and melons

Pest	No. Trials	No. Applications	IPM Standard	Comparative Efficacy
Leps –Foliar	14	30	Radiant, Diamides	A
Leps -Soil	12	14	Coragen, Durivo	A
Whiteflies-Foliar	22	40	Movento, Neonicotinoids	A
Whiteflies-Soil	18	34	Neonicotinoids	A
Leafminer	8	15	Radiant, Coragen	A
Seed corn maggot	4	4	Pyrethroids	A-B
Flea beetle	4	7	Pyrethroids	B
Thrips	6	14	Radiant, Lannate	B
Aphids	10	26	Movento, Neonicotinoids	B
Bagrada Bug	7	14	Pyrethroids, Lannate	C

A	Excellent activity; As good as the standard
B	Inconsistent activity; Not as good as the standard
C	Not economically effective

Cyazypyr was recently registered in Arizona. Cyazypyr is not a new chemistry, but rather a 2nd generation Anthranilic diamide. Like other diamides, it is a neurotoxin and considered a ryanodine receptor agonist. What sets Cyazypyr apart from the other diamides is its unique cross-spectrum activity; will control sucking and chewing pests. As a foliar spray, Exirel has excellent activity against beet armyworm, cabbage looper, corn earworm, whitefly adults and nymphs, and leafminers in one spray pass. When applied as a soil systemic at-planting to leafy vegetables, Verimark has provided residual control of armyworm and looper comparable to Coragen (26-30 d), and even longer residual control (~40 d) of whitefly nymphs and leafminers. It has efficacy against flea beetles, aphids and thrips; albeit not quite as consistent as the standards. It has shown no economic activity against Bagrada bugs. It also is considered a reduced-risk compound and should be a great fit in our local IPM programs and particularly a great alternative for resistance management of whiteflies.

Torac (*tolfenpyrad*)

Chemistry:	Pyrazole
IRAC Mode of Action:	Group 21A, METI transport inhibitor
Route of Activity:	Foliar contact
Effective Spectrum:	Western Flower Thrips
Recommended Rates:	Foliar, 21 oz
Key Desert Fit:	Rotational/Tank mix alternative to pyrethroids

Pest	No. Trials	No. Sprays	IPM Standard	Comparative Efficacy
Thrips	18	45	Radiant, Lannate	A-B
Whiteflies	5	12	Movento, Venom	B
Aphids	10	20	Movento, imidacloprid	B
Flea beetles	4	7	Pyrethroids	B
Lep larvae	3	6	Radiant, Proclaim	B
Bagrada bug	5	10	Pyrethroids , Venom	B

A	Excellent activity; As good as the standard
B	Inconsistent activity; Not as good as the standard
C	Not economically effective

Torac (*tolfenpyrad*) was registered in 2014. As a pyrazole, the mode of action for Torac is as a Mitochondrial complex I electron transport inhibitor. In essence, it is a metabolic toxin where once the insect comes in contact with the compound energy metabolism is shut down. Although not a new chemistry, it will be fairly unique in leafy vegetable where METI compounds are not presently used. It has activity against western flower thrips as a standalone product, although not as consistent as either Radiant or Lannate. However, it has shown excellent thrips activity when used in combination with either of these two products. Long term it may be an alternative to pyrethroids in tank mixtures for thrips control. It has shown to have inconsistent activity against a broad range of sucking and chewing pests (beet armyworm, flea beetles, aphids) providing quick knockdown, but only marginal residual (e.g., much like a pyrethroid). It has foliar contact activity only and thus good spray coverage is essential for good control.

Spectrum of Effective Pest Efficacy on Desert Vegetables

	Lep Larvae	Leafminer	Whitefly	Thrips	Aphids	Flea beetles
Exirel, Verimark						
Sequoia						
Sivanto						
Torac				<i>Tank-mix</i>		

