

Cotton Insecticide Use Guide

Knowing and Balancing Risks

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Many factors must be considered when choosing an insecticide, such as cost, efficacy, risk of resistance, and safety to non-target organisms. This **Cotton Insecticide Use Guide** summarizes the diverse risks of insecticides used to control three pests, helping you make well informed pest management decisions.

Product Risks to Arthropod Natural Enemies

Beneficial predators like *Orius* pirate bugs, *Geocoris* big-eyed bugs, crab spiders, *Collops* beetles, lacewing larvae, and *Drapetis* flies provide free biological control. Check product selectivity or compatibility with these natural enemies by looking at the background colors.

Fully Selective	GREEN: LOW risk to natural enemies
Partially Selective	YELLOW: MODERATE risk to natural enemies
Not selective	RED: HIGH risk to natural enemies

Product Efficacy

Consider efficacy of products against the target pest, based on the number of stars. Check whether insecticides provide control of specific life stages by checking letters next to stars.

Product Name	Common Name	IRAC No. ¹	Chemical Group	Silverleaf Whitefly
Courier	buprofezin	16	Chitin inhibitor	★★★★ (N)
★★★★ excellent	★★ fair	E,N = efficacy against eggs & nymphs only, respectively		
★★★ good	★ suppression			

Resistance Management

Resistance can erode the efficacy of any product, but levels vary geographically and seasonally. Comments indicate resistance levels of whiteflies to products. Where resistance has not yet been detected in Arizona's populations, the cell is left blank.

SWF, Risk of Resistance
under investigation
mild-moderate

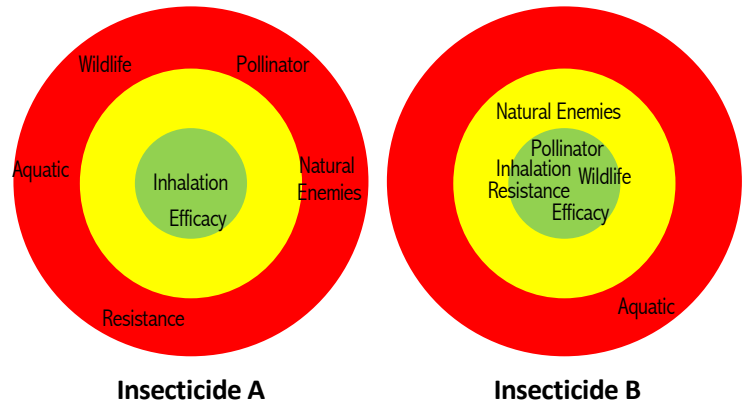
Risk to Human Health & the Environment

Identification of risk is based on scientific assessment. Check level of risk to bystanders, pollinators, and aquatic and terrestrial wildlife. "Yes" indicates a **significant risk of concern** has been identified. A blank cell does not indicate lack of any risk. Some risk is associated with the use of any product, especially to pesticide applicators, who should follow all personal protective equipment and other requirements for applying pesticides safely.

Risk to Aquatic Life (fish, algae)	Risk to Wildlife (mammals, birds)	Risk to Pollinators (bees)	Inhalation Risk (human bystanders)
Yes		Yes	
Yes	Yes	Yes	

Choosing Products Wisely = Minimizing Risks

Perhaps the worst product a grower could choose is the one that doesn't work. Risks are minimized by choosing insecticides that are effective against pests, while providing safety to natural enemies and other non-target organisms, and to human health.



Each insecticide decision carries with it a variable combination of risks. The **Cotton Insecticide Use Guide** identifies 7 different risk factors (selectivity towards natural enemies, target pest efficacy, aquatic life, terrestrial wildlife, pollinators, bystander inhalation, and insecticide resistance in whitefly populations). Where possible, a grower should target products that minimize these risks. While "Insecticide A" has excellent target pest efficacy and very low risks to bystander health, it poses high risks to natural enemies, pollinators, aquatic and terrestrial wildlife, and higher risks for resistance development in whiteflies. "Insecticide B" poses a low risk to all factors, except for natural enemies (moderate risk) and aquatic life (high risk). The ultimate goal is to aim for excellent efficacy while minimizing risks as much as possible. In this example, "Insecticide B" fulfills this criteria better than "Insecticide A".

Each decision and every product has risk. Even when risk is not shown on the table, some level of risk will be present. Minimizing these risks conserves biocontrol and avoids catastrophic ecological effects that can increase the need for future sprays to control primary pests that resurge (e.g., whiteflies) or secondary pests that break out (e.g., mites).

Economic risks are important, too! Consider product cost and value alongside factors shown in the table. A lower-priced insecticide that slightly increases other risks may sometimes be the best choice. However, growers should consider the broad set of risks associated with insecticide use and avoid the false economy of always choosing the "cheapest" insecticide. The IPM goal should be to identify, balance and prioritize all insecticide risks, considering them on a case-by-case basis, for each grower and system.

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Cotton Insecticide Use Guide. Insecticides have been screened for efficacy against target pests, *Lygus hesperus*, *Bemisia argentifolii* (MEAM1; silverleaf whitefly, SWF), and *Euschistus servus* (brown stink bug); as well as for their impact on non-target beneficial arthropods including >20 predators common in Arizona cotton. Those insecticides with full selectivity or safety towards these beneficial predators are in green; those that are partially selective or safe are in yellow; broad spectrum insecticides are in red. Some insecticides pose environmental and human health risks that require mitigations such as buffer zones and additional personal protective equipment (PPE). IRAC group numbers are provided to facilitate rotation of chemistry and SWF resistance risks are presented.

Product Name	Common Name	IRAC No. ¹	Chemical Group	Lygus Bug	Silverleaf Whitefly	Brown Stink Bug	Risk to Aquatic Life	Risk to Wildlife	Risk to Pollinators	Inhalation Risk	SWF, Risk of Resistance
Carbine	flonicamid	29	Feeding inhibitor	★★★★							
Courier	buprofezin	16	Chitin inhibitor		★★★★ (N)						under investigation
Exirel / Benevia	cyantranilprole	28	Diamide		★★★★						
Knack / Farewell	pyriproxyfen	7C	Juvenoid		★★★★ (E,N)						mild–moderate
Oberon ²	spiromesifen	23	Lipid synthesis inhibitor		★★★★ (N)						under investigation
PQZ	pyrifluquinazon	9B	Pyridine azomethine		★★★★						
<i>Sefina Inscalis</i>	<i>afidopyropen</i>	<i>9D</i>	<i>Pyropene</i>		★★★						
Sivanto prime	flupyradifurone	4D	Butenolide		★★★★						
Transform	sulfoxaflor	4C	Sulfoxamine	★★★★	*						
Assail / Intruder ³	acetamiprid	4A	Neonicotinoid		★★★★		Yes				moderate–severe
Belay	clothianidin ⁴	4A	Neonicotinoid	★★	★★		Yes		Yes		
Centric	thiamethoxam ⁴	4A	Neonicotinoid		★★		Yes		Yes		
Venom	dinotefuran	4A	Neonicotinoid		★★★		Yes		Yes		
Acephate	acephate	1B	Organophosphate	★★★		*		Yes	Yes		
Bidrin	dicrotophos ⁵	1B	Organophosphate	*		*	Yes	Yes	Yes	Yes	
Cormoran	novaluron + acetamiprid	15 + 4A	Chitin inhibitor	★★ (N)	★★	* (N)	Yes				
Diamond / Mayhem	novaluron	15	Chitin inhibitor	* (N)	*	* (N)	Yes				
Synergized pyrethroids	various ⁶	3A + 1B	Pyrethroid + organophosphate		★★		Yes	Yes	Yes		moderate–severe
Vydate C-LV	oxamyl ⁵	1A	Carbamate	★★★★			Yes	Yes	Yes	Yes	

Background color: **Green** = Fully selective and safe to beneficials; **Yellow** = Partially selective or safe to beneficials; **Red** = broad spectrum, not safe to beneficials; *Italics* = based on preliminary testing.

Risks as calculated from ipmPRIME (Jepson et al. 2014); ‘Yes’ indicates moderate to high risk for the given category.

★★★★, Excellent control; ★★★, Good control; ★★, Fair control; ★, Suppression only; E, N = Efficacy against eggs or nymphs only, respectively.

¹ The Insecticide Resistance Action Committee (IRAC) assigns numbers for each unique mode of action or class of chemistry. Many appear on U.S. insecticide labels and are helpful for resistance management.

² At 0.125–0.156 lbs ai / A only; higher rates are more destructive of natural enemies.

³ The State of Arizona has approved a Special Local Needs (SLN) increase in acetamiprid use rates by up to +50% against difficult-to-control whiteflies. Impact to beneficials is more severe at these higher rates.

⁴ This active ingredient can significantly affect bee populations, other pollinators and birds, can persist for years in soils, and can leach into waterways and groundwater.

⁵ This active ingredient is considered highly hazardous by the World Health Organization (WHO Ib), a restricted use pesticide with signal words DANGER and POISON, requiring posting, additional PPE, and closed systems. Avoid if possible.

⁶ Beta-cyfluthrin and zeta-cypermethrin are considered highly hazardous by the World Health Organization (WHO Ib), are restricted use pesticides with signal words WARNING, and should be avoided when possible.

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