Cucurbits and Fruiting vegetables

A guide to pesticide effects on beneficials

2020

About this guide

This guide provides information on the effects of pesticides on key beneficial insects and mites that are important in cucurbit and fruiting vegetable crops. The results presented in the guide below have been compiled from several sources which include scientific literature, international pesticide data bases, the results of testing that has been conducted for project VG16067 'Impact of pesticides on beneficial arthropods of importance in Australian vegetable production' and field observations. The intended use of this guide is to provide growers and agronomists with a better understanding of how best to use pesticides in an IPM program to maximize the impact of beneficial species.

The products included were selected because they are currently registered (in 2019) for use in cucurbit and fruiting vegetable crops and because of their potential to be incorporated into IPM programs. Some products that are not considered to be IPM compatible have also been included as a comparison of relative toxicity.

About the testing

The information in this guide is based on the results of laboratory-based tests and not field tests. Laboratory tests are designed to be the worst-case scenario. In these tests the product is applied at the highest label rate to the most vulnerable life stage. This means that products with low toxicity are most likely to be very safe when applied to a crop and products that show medium to high toxicity have the potential to disrupt beneficial species. How disruptive a product is will depend on the frequency of use, application rate, the age of the crop, how well established the beneficials are at the time of application and if the crop is grown in the field or in a glasshouse.

Acute and sublethal testing

We used two levels of testing and the first is acute which aims to measure the impact of direct exposure to the product. In these tests beneficial species were exposed to the product for 24 or 48 hours and then the level of mortality was assessed. If mortality was less than 30%, they were then tested for sublethal effects. For the development of this guide sublethal tests were designed to answer two questions 1. For predators only - do the juveniles that survive the acute test develop into adults? 2. For predators and parasites – are adults that have been exposed to the product able to reproduce? The results of sub-lethal testing are only shown in this guide if the results differ from the acute toxicity. A blue triangle ▽ indicates that the results are a combination of both acute and sub-lethal. A white triangle ▽ means acute results only.

*The protocols for testing and the references for results that were not developed as part of this project are available in a separate document.

Table 1: Codes for beneficial species used in the guide

code		code		code	
G	**Green lacewing** *(Mallada signatus)* Generalist predator	**O**	**Orius** *(Orius tantillus).* Thrips predator	**C**	**Californicus** *(Neoseiulus californicus)* Predatory mite
A	**Aphidius** *(Aphidius colemani)* Aphid parasite	**L**	**Ladybird** *(Hippodamia variegata)* Aphid predator	**E**	**Encarsia** *(Enacrsia formosa)* White fly parasite
P	**Persimilis** *(Phytoseiulus persimilis)* Predatory mite				

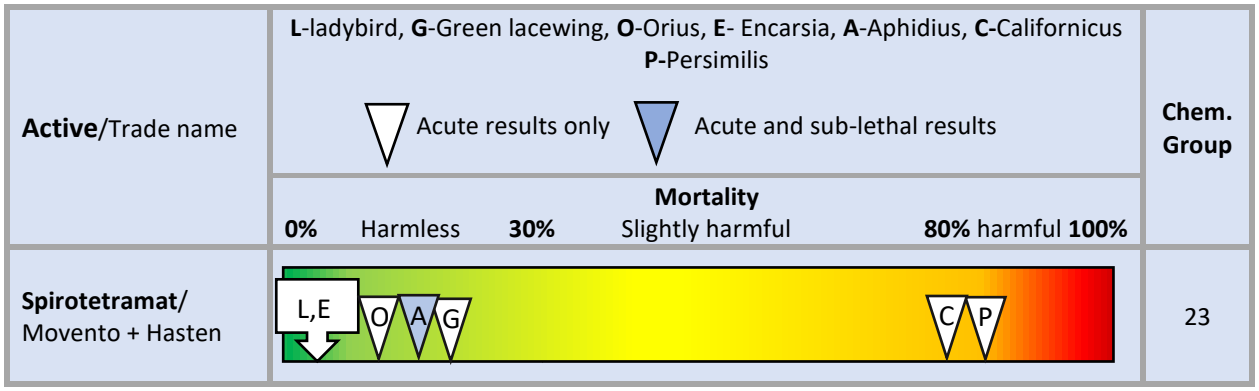
About the beneficial species

The beneficials tested are species that are naturally occurring and commercially available and are considered important for IPM in cucurbits. For the acute tests the juvenile stage of the predatory species was used and for the parasitoids the adult wasps were used.

How to interpret this guide

The relative toxicity for each species is indicated on a scale from 0% to 100% mortality as shown in the example below.

This example shows that Spirotetramat (Movento) is safe to ladybirds (**L**) Encarsia (**E**) Aphidius (**A**) Orius (**O**) and Green lacewings (**G**) but is harmful to predatory mites Californicus (**C**) and Persimilis (**P**).



When deciding to use this product things to consider are:

- How many other products have been used on the crop and what impact did they have on predatory mites?
- Will two-spotted mite flare if predatory mites are disrupted? And if so, can the flare be managed?
- Will there be an economic loss if this product is not applied?
- Is there another product that that could be used that is less disruptive?

Pesticides and IPM

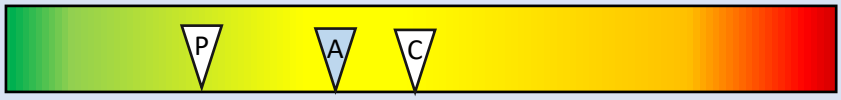
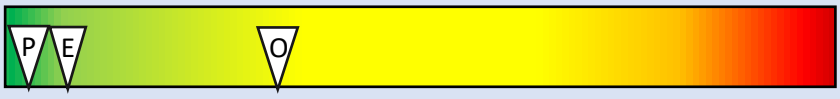
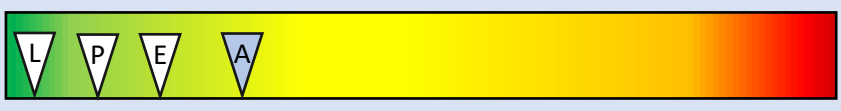
The results presented here are based on worse-case scenario laboratory testing. In the field it is likely that the effects will be less toxic for some of the products shown in this guide. However, the impact of pesticides on beneficial species is cumulative which means that the impact is the combined effects of all pesticides used. This is particularly relevant for growers wanting to maintain healthy populations of beneficial species on their farms and for growers investing in commercially available biological control.

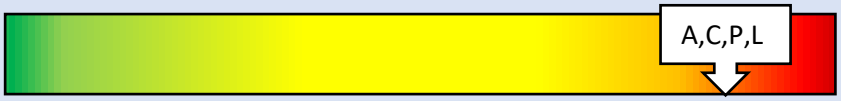
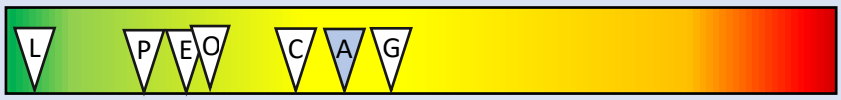
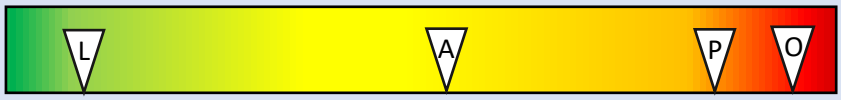
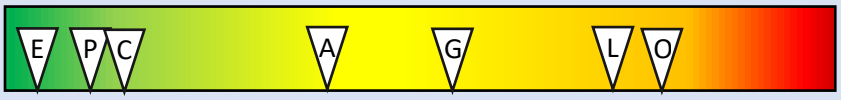
The guide for Cucurbits and Fruiting vegetables

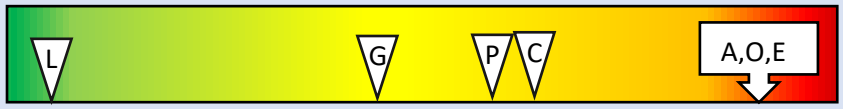
The information presented in the guide below is intended to be used as a support tool for IPM decision making and not to be interpreted as a list of “good and bad” or “safe and not safe” products.

*Information is currently not available for all the beneficial species listed in this guide which is why some of the products only show results for a few species.

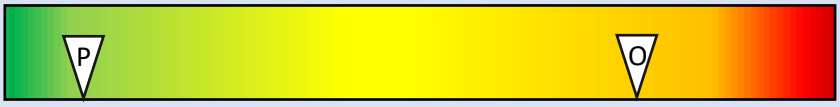
Pesticides in order by active ingredient

Active/Trade name	**L**-ladybird, **G**-Green lacewing, **O**-Orius, **E**- Encarsia, **A**-Aphidius, **C**-Californicus **P**-Persimilis ▽ Acute results only ▼ Acute and sub-lethal results **Mortality** **0%** Harmless **30%** Slightly harmful **80%** harmful **100%**	**Chem. Group**
Abamectin /Vertimec		6
Afidopyrofen /Versys		9D
Bacillus thuringiensis /Dipel and Xentari		11A
Bifenazate /Acramite		20D
Bifenthrin /Talstar		3A
Buprofezin /Applaud		16
Chlorantraniliprole /Coragen		28

Chlorpyrifos /Lorsban		1B
Clothianadin /Samurai		4A
Cyantraniliprole /Benevia		28
Emamectin Benzoate /Proclaim		6A
Etoxazole /Paramite		10B
Flonicamid /Mainman		9C
Flubendiamide /Belt		28
Hexythiazox /Calibre		10A
Imidacloprid /Confidor		4A
Indoxacarb /Avatar		22A
Milbemectin /Milbeknock		6
NPV /Vivus		31
Pirimicarb /Pirimor		1A

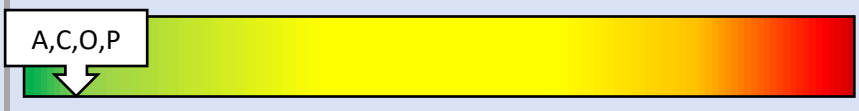
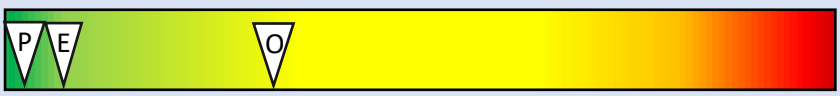
Pyriproxyfen /Admiral Advance		9B
Spinetoram /Success Neo		5
Spirotetramat /Movento		23
Sulfoxaflor /Transform		4C

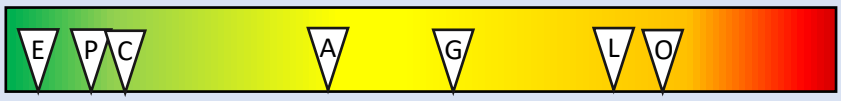
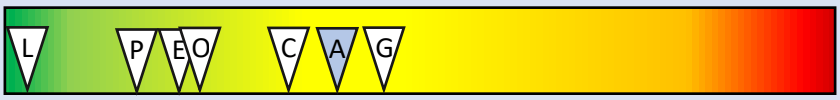
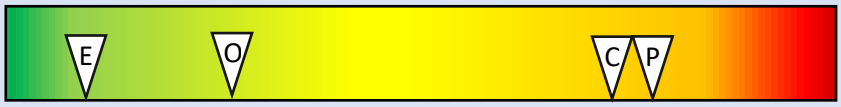
Fungicides in order by active ingredient

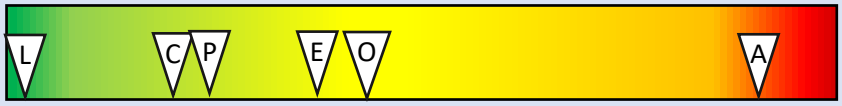
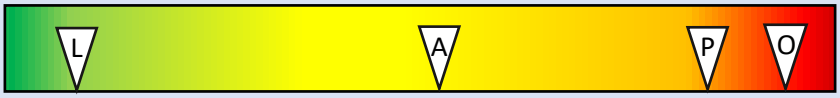
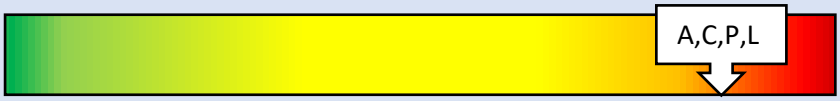
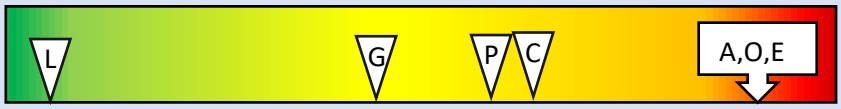
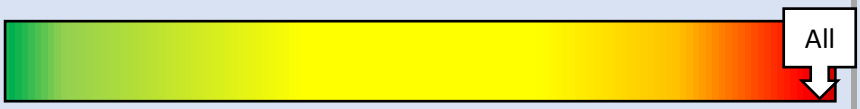
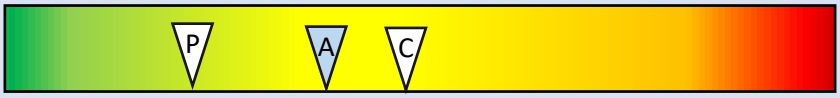
Active/trade name	**L**-ladybird, **G**-Green lacewing, **O**-Orius, **E**- Encarsia, **A**-Aphidius, **C**-Californicus **P**-Persimilis Acute results only — Acute and sub-lethal results **Mortality** **0%** Harmless **30%** Slightly harmful **80%** harmful **100%**	**Chem. Group**
Azoxystrobin /Amistar		11
Boscalid +Kresoxim-Methyl /Colliss		7 11
Chlorothalonil		M5
Cyflufenamid /Flute		U6
Cypodinal+ Fludioxonil /Switch		9 12
Dimethomorph /Acrobat		40

Mancozeb		M3
Metalaxyl /Ridomil Gold		4
Metiram /Polyram		M3
Oxathiapiprolin /Zorvec Enicade		49
Penthiopyrad /Fontelis		7
Propamocarb Hydrochloride + Fluopicolide /Infinito		28 43
Triadimenol /Bayfidan		3
Zineb		Y

Pesticides in order by trade name

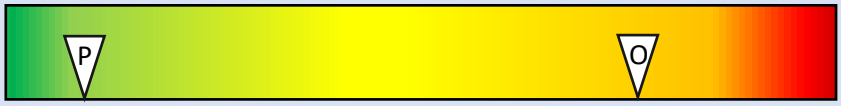
Trade name/Active	**L**-ladybird, **G**-Green lacewing, **O**-Orius, **E**- Encarsia, **A**-Aphidius, **C**-Californicus **P**-Persimilis Acute results only ▽ Acute and sub-lethal results ▼ **Mortality** **0%** Harmless **30%** Slightly harmful **80%** harmful **100%**	**Chem. Group**
Acramite /Bifenazate		20D
Applaud /Buprofezin		16

Admiral Advance /Pyriproxyfen		9B
Avatar /Indoxacarb		22A
Belt /Flubendiamide		28
Benevia /Cyantraniliprole		28
Calibre /Hexythiazox		10A
Confidor /Imidaclopropid		4A
Coragen /Chlorantraniliprole		28
Dipel and **Xentari** /Bacillus thuringiensis		11A
Lorsban /Chlorpyrifos		1B
Mainman /Flonicamid		9C
Milbeknock /Milbemectin		6
Movento /Spirotetramat		23
Paramite /Etoxazole		10B

Pirimor /Pirimicarb		1A
Proclaim /Emamectin Benzoate		6A
Samurai /Clothianadin		4A
Success Neo /Spinetoram		5
Talstar /Bifenthrin		3A
Transform /Sulfoxaflor		4C
Versys /Afidopyrofen		9D
Vertimec /Abamectin		6
Vivus /NPV		31

Fungicides in order by Trade name

Trade name/Active	**L**-ladybird, **G**-Green lacewing, **O**-Orius, **E**- Encarsia, **A**-Aphidius, **C**-Californicus **P**-Persimilis Acute results only Acute and sub-lethal results **Mortality** **0%** Harmless **30%** Slightly harmful **80%** harmful **100%**	**Chem. Group**
Amistar /Azoxystrobin		11

Acrobat /Dimethomorph		40
Bayfidan /Triadimenol		3
Chlorothalonil		M5
Colliss /Boscalid +Kresoxim-Methyl		7 11
Flute /Cyflufenamid		U6
Fontelis /Penthiopyrad		7
Infinito /Propamocarb Hydrochloride + Fluopicolide		28 43
Mancozeb		M3
Polyram /Metiram		M3
Ridomil Gold /Metalaxyl		4
Switch /Cypodinal+ Fludioxonil		9 12
Zineb		Y
Zorvec Enicade /Oxathiapiprolin		49

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