



# Leafy vegetables and head lettuce

## A guide to pesticide effects on beneficials

2020

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### About this guide



This guide provides information on the effects of pesticides on key beneficial insects that are important in leafy vegetables and head lettuce 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 leafy vegetable and head lettuce 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.

## About the beneficial species

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

**Table 1: Codes for beneficial species used in the guide**

code



**D** **Diadegma**  
(*Diadegma semiclausum*)  
DBM parasite



**A** **Aphidius**  
(*Aphidius colemani*)  
Aphid parasite

code



**B** **Brown lacewing** (*Micromus tasmaniae*).  
Aphid predator



**L** **Ladybird**  
(*Hippodamia variegata*)  
Aphid predator

code



**N** **Damsel bug**  
(*Nabis kinbergii*)  
Caterpillar predator

## 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 Spinetoram is safe to ladybirds (**L**) and Damsel bugs (**N**) but is harmful to Aphidius and (**A**) Diadegma (**D**) and Brown lacewings (**B**).

Active/Trade name	L-ladybird, B-Brown lacewing, N-Damsel bug, D-Diadegma, A-Aphidius,	Chem. Group
	Mortality	
	0% Harmless 30% Slightly harmful 80% harmful 100%	
Spinetoram /Success Neo		5

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 brown lacewings, Aphidius and Diadegma?
- 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.


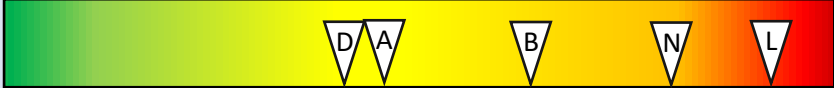









# The guide for Leafy vegetables and head lettuce

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.

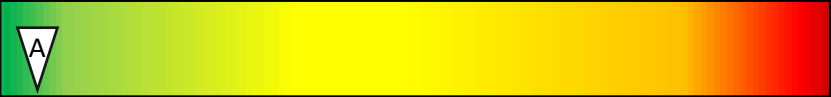
## Pesticides in order by active ingredient

Active/Trade name	L-ladybird, B-Brown lacewing, N-Damsel bug, D-Diadegma, A-Aphidius,  Acute results only  Acute and sub-lethal results	Chem. Group
	<p style="text-align: center;"><b>Mortality</b></p> <p>0%    Harmless    30%    Slightly harmful    80% harmful    100%</p>	
<b>Abamectin</b> /Vertimec		6
<b>Afidopyrofen</b> /Versys		9D
<b>Bacillus thuringiensis</b> /Dipel and Xentari		11A
<b>Chlorpyrifos</b> /Lorsban		1B
<b>Chlorantraniliprole</b> /Coragen		28
<b>Emamectin Benzoate</b> /Proclaim		6A
<b>Fipronil</b> /Regent		2B
<b>Flubendiamide</b> /Belt		28





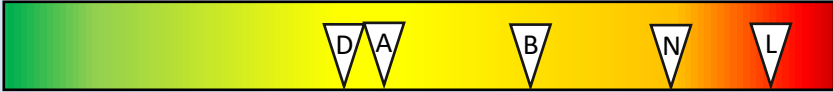






<b>Imidacloprid</b> /Confidor		4A
<b>Indoxacarb</b> /Avatar		22A
<b>Methomyl</b> /Lannate		1A
<b>NPV</b> /Vivus		31
<b>Permethrin</b> /Ambush		31
<b>Pirimicarb</b> /Pirimor		1A
<b>Pyriproxyfen</b> /Admiral Advance		9B
<b>Pymetrozine</b> /Chess		9B
<b>Spinetoram</b> /Success Neo		5
<b>Spirotetramat</b> /Movento		23
<b>Sulfoxaflor</b> /Transform		4C




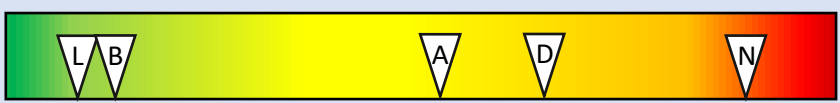



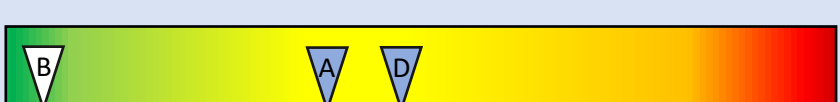
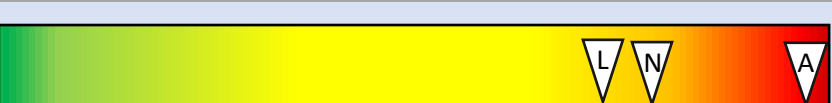

## Fungicides in order by active ingredient

Active/Trade name	L-ladybird, B-Brown lacewing, N-Damsel bug, D-Diadegma, A-Aphidius,  Acute results only  Acute and sub-lethal results	Chem. Group
	<b>Mortality</b> 0% Harmless    30% Slightly harmful    80% harmful 100%	
<b>Azoxystrobin</b> /Amistar		11
<b>Boscalid</b> /Filan		7 11
<b>Cyazofamid</b> /Ranman		21
<b>Cyflufenamid</b> /Flute		U6
<b>Cyprodinal+ Fludioxonil</b> /Switch		9 12
<b>Mancozeb</b>		M3
<b>Mandipropamid</b> /Revus		40
<b>Metalaxyl</b> /Ridomil Gold		4
<b>Oxathiapiprolin</b> /Zorvec Enicade		49
<b>Propamocarb Hydrochloride + Fluopicolide</b> /Infito		28 43
<b>Triadimenol</b> /Bayfidan		3

Zineb		Y
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### Pesticides in order by trade name

Trade name /Active	L-ladybird, B-Brown lacewing, N-Damsel bug, D-Diadegma, A-Aphidius,  Acute results only  Acute and sub-lethal results	Chem. Group
	<p style="text-align: center;"><b>Mortality</b></p> 0%    Harmless    30%    Slightly harmful    80% harmful    100%	
<b>Admiral Advance</b> /Pyriproxyfen		9B
<b>Permethrin</b> /Ambush		31
<b>Indoxacarb</b> /Avatar		22A
<b>Flubendiamide</b> /Belt		28
<b>Pymetrozine</b> /Chess		9B
<b>Imidacloprid</b> /Confidor		4A
<b>Chlorantraniliprole</b> /Coragen		28
<b>Dipel and Xentari</b> /Bacillus thuringiensis		11A
<b>Methomyl</b> /Lannate		1A

<b>Chlorpyrifos</b> /Lorsban		1B
<b>Movento</b> /Spirotetramat		23
<b>Pirimicarb</b> /Pirimor		1A
<b>Proclaim</b> /Emamectin Benzoate		6A
<b>Fipronil</b> /Regent		2B
<b>Success Neo</b> /Spinetoram		5
<b>Transform</b> /Sulfoxaflor		4C
<b>Versys</b> /Afidopyrofen		9D
<b>Vertimec</b> /Abamectin		6
<b>Vivus</b> /NPV		31



## Fungicides in order by Trade name

Trade name /Active	L-ladybird, B-Brown lacewing, N-Damsel bug, D-Diadegma, A-Aphidius,  Acute results only  Acute and sub-lethal results	Chem. Group
	<b>Mortality</b> 0% Harmless     30% Slightly harmful     80% harmful 100%	
<b>Amistar</b> /Azoxystrobin		11
<b>Bayfidan</b> /Triadimenol		3
<b>Filan</b> /Boscalid		7 11
<b>Flute</b> /Cyflufenamid		U6
<b>Infinito</b> /Propamocarb Hydrochloride + Fluopicolide		28 43
<b>Mancozeb</b>		M3
<b>Ranman</b> /Cyazofamid		21
<b>Ridomil Gold</b> /Metalaxyl		4
<b>Switch</b> /Cypodinal+ Fludioxonil		9 12
<b>Zorvec Enicade</b> /Oxathiapiprolin		49
<b>Zineb</b>		Y

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