



Impact of insecticides on beneficial insects in Australian grain crops

Building and/or conserving populations of beneficial insects is a cornerstone of Integrated Pest Management (IPM). While there is a growing awareness and interest in the role of beneficial insects in the grains industry, insecticides (and miticides) can have adverse impacts on beneficial insect populations present at the time of application.

This can hinder pest management efforts by removing beneficial insects, such as predators and parasitoids, from the local environment - which play an important role in naturally keeping pest populations in check.

To assist growers and advisors in making informed choices around insecticide use in Australian grain crops, the below table summarises the toxicity of foliar chemical sprays on key beneficial insects (Table 1).

To produce this table, Cesar Australia has collected new data through laboratory testing and compiled this with previous research. In Version 2.0, we have placed emphasis on making this a robust guide for Australia by selecting toxicity data on beneficial species that are present in Australia (unless otherwise stated). Research to fill remaining data gaps is ongoing.

Ratings for toxicity are based on International Organisation for Biological Control (IOBC) protocols for laboratory studies and reflect percent mortality of insects within a particular beneficial group exposed to each chemical. A rating of L represents <30% mortality, M 30-79%, H 80-99% and VH >99% mortality. These values represent mortality under controlled laboratory conditions – impacts may vary in the field, especially if multiple applications of a chemical occur. Where a range is presented, this represents varying results among species or chemicals within a group. Combinations of chemicals and insects with a wide range of ratings are shown in cells with a diagonal slash.

For further details about the underlying toxicity data, contact Cesar Australia at info@cesaraustralia.com.

Where growers are able to monitor and identify important local beneficial species, targeted spray decisions can be made so as to minimise harm to key beneficial groups that are present. In situations where monitoring for beneficial insects is not feasible, and knowledge of the beneficial species present in the local environment is limited, growers may select the overall least toxic chemical from the list that is effective against the target pest.



Table 1: Impact of insecticides on beneficial insects in Australian grain crops

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Active ingredient	Mode of Action 1	Rate (g ai/ha) 2	Ladybird beetles 3	Rove beetles 4	Hoverflies 5	Aphid parasitoids 6	Lepidopteran larval parasitoids 7	Egg parasitoids 8	Predatory bugs 9	Lacewings 10	Predatory mites 11	Spiders 12
Nucleopolyhedrovirus 13	31	100	L	L	-	L	L	L	L	L	L	-
Bacillus thuringiensis 13	11A	3286	L	L	-	L	L	L	L	L	L	L
Chlorantraniliprole	28	24.5	L	L	L	L	L	L	L	L	L	L
Fonicamid	29	50	L	L	L	L	L	M	L	L	L	L
Afidopyropen	9D	5	L-H	L	L	L	L	L	L	L	L-M	L
Pirimicarb Low 14	1A	75	L	L	L	VH	L	VH	L	L	L-M	L
Paraffinic oil	-	1584	M	L	-	L-VH	L	L	L-M	L	L	-
Indoxacarb	22A	60	M-H	L	L	L-VH	VH	L	L-M	L	L	-
Emamectin benzoate	6	5.1	L	L	L	M-H	VH	VH	M	L	M	-
Abamectin	6	5.4	M-H	L	-	M-H	L	VH	M-H	M	M	L
Pirimicarb High 14	1A	500	L-M	L	L	VH	M-VH	VH	M	L	M	-
Spinetoram	5	36	L-M	L	-	H-VH	VH	H	L-M	M	L-H	-
Gamma-cyhalothrin 15	3A	4.5	VH	L	L	L-M	VH	VH	VH	VH	L-VH	L
Diafenthiuron	12A	300	M-VH	L	L	M-VH	VH	L	VH	L	M-VH	-
Sulfoxaflor	4C	50	L	L	-	H-VH	VH	VH	VH	L	L	-
Thiodicarb	1A	281.25	H-VH	L	-	M-VH	M	VH	M	L	H	L
Synthetic Pyrethroids (excl. Gamma-cyhalothrin) 16	3A	Variable	H-VH	M	H	L-VH	VH	VH	H-VH	VH	L-VH	VH
Methomyl	1A	450	VH	VH	-	VH	M	VH	H-VH	VH	VH	-
Organophosphates 17	1B	Variable	H-VH	M-VH	L-H	VH	VH	VH	VH	VH	L-VH	H-VH



Mortality									
L	<30%	M	30-79%	H	80-99%	VH	>99%	-	Data not yet available

This work represents a collaboration between Cesar Australia and the University of Melbourne, with investment from the Grains Research and Development Corporation as part of the Australian Grains Pest Innovation Program (AGPIP).

Footnotes

- 1 The Mode of Action of each active ingredient follows the Insecticide Resistance Action Committee classification (<https://irac-online.org/modes-of-action/>).
- 2 Active Ingredients were typically tested at their Maximum Registered Field Rates (MRFR) per hectare in Australian grain crops. Data from previous research trials were included if those studies tested rates within 35% of the MRFR.
- 3 Data based on *Adalia bipunctata*, *Coccinella septempunctata*, *Coccinella transversalis*, *Harmonia axyridis*, *Harmonia conformis*, *Hippodamia convergens* (international species) and *Hippodamia variegata*.
- 4 Data based on *Dalotia* spp.
- 5 Data based on *Melangyna* spp.
- 6 Data based on *Aphelinus abdominalis*, *Aphidius colemani* and *Diaeretiella rapae*.
- 7 Data based on *Diadegma semiclausum*, *Microplitis croceipes*, *Microplitis demolitor* and *Microplitis mediator*.
- 8 Data based on *Telenomus remus* (international species), *Trichogramma carverae* and *Trichogramma pretiosum*.
- 9 Data based on *Nabis kinbergii*, *Orius insidiosus* (international species), *Orius laevigatus* (international species), *Orius tantillus* and *Pristhesancus plagipennis*.
- 10 Data based on *Mallada signatus* and *Micromus tasmaniae*.
- 11 Data based on *Hypoaspis aculeifer*, *Odontoscirus lapidaria*, *Phytoseiulus persimilis*, *Typhlodromus montdorensis* and *Typhlodromus pyri*.
- 12 Data based on *Cheiracanthium* spp., *Pardosa* spp., *Theridion impressum* (international species) and *Venatrix* spp.
- 13 Rates listed for biologicals are the amount of product per hectare rather than amount of active ingredient. The listed rate for *Bacillus thuringiensis* is applicable to Dipel™ (g) and the listed rate for nucleopolyhedrovirus is applicable to Vivus Armigen™ (mL). Application rates for other products may vary.
- 14 Pirimicarb is shown at two rates due to its variation in application rates in Australian grain crops.
- 15 Gamma-cyhalothrin is listed separately to other synthetic pyrethroids due to lower mortality rates observed for some beneficial insects compared with other active ingredients in this Mode of Action group.
- 16 Synthetic pyrethroids included here are alpha-cypermethrin, bifenthrin, cypermethrin and lambda-cyhalothrin.
- 17 Organophosphates included here are chlorpyrifos, dimethoate, omethoate and phosmet.

Disclaimer: Information provided in Table 1 is based on the current best information available from research data. The impact of insecticides may vary in the field and between crop types. Users of chemical products should check the label for further details of rate, pest spectrum, safe handling and application. Further information on the products can be obtained from the manufacturer. Cesar Australia and GRDC accept no responsibility whatsoever for any loss occasioned by any person acting or refraining from action as a result of reliance on this data.

Authors: Rosie Knapp (Cesar Australia), Robert McDougall (Cesar Australia), Kathy Overton (Cesar Australia), Ary Hoffmann (The University of Melbourne), Samantha Ward (Cesar Australia) and Paul Umina (Cesar Australia).

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