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RESISTANCE MANAGEMENT STRATEGY FOR THE GREEN PEACH APHID IN AUSTRALIAN GRAINS

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KEY POINTS

- Green peach aphids (GPA) are a widespread and damaging pest of canola and a range of pulse crops, causing damage by feeding and transmitting viruses.
- Five chemical subgroups are registered to control GPA in grain crops: carbamates (Group 1A); synthetic pyrethroids (Group 3A); organophosphates (Group 1B); neonicotinoids (Group 4A); and sulfoxaflor (Group 4C). Paraffinic spray oils are also registered for suppression of GPA.
- High levels of resistance to carbamates and pyrethroids are now widespread across Australia. Moderate levels of resistance to organophosphates have been observed in many populations, and there is evidence that resistance to neonicotinoids is evolving.
- A strategy to manage insecticide resistance in GPA populations is available for use by grain growers and their advisers.
- The strategy may vary across regions and industries to be effective.

PHOTO: A. WEEKS (CESAR)

The use of chemicals to control green peach aphids in oilseed, pulses and vegetable crops continues to grow in Australia, placing strong selection pressure on the development of resistance in this species.

Green peach aphids and insecticide resistance

In Australia, the green peach aphid (GPA), *Myzus persicae*, primarily attacks canola and pulse crops, as well as being a common pest in horticulture. The aphids feed by sucking sap from leaves and flower buds. When populations are large the crop's entire foliage may be covered, resulting in retarded growth of young plants. Young vegetative canola is most susceptible to GPA damage during autumn. Although GPA may be found in canola at later stages, their numbers are usually insufficient to cause significant yield loss. GPA can transmit more than 100 plant viruses, such as beet western yellows virus (BWYV) and cucumber mosaic virus (CMV).

The use of chemicals to control GPA in oilseed, pulses and vegetable crops continues to grow in Australia, placing strong selection pressure on the development of resistance in GPA. As aphids produce offspring that are clones of the mother, resistant individuals can soon dominate a landscape if there is widespread use of the same insecticide across paddocks and farms.

With resistance to three key insecticide groups already established, and resistance potentially developing to a fourth, growers need to understand how to minimise the further development of resistance.

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Resistance management and minimisation strategy

The aim of this strategy is to minimise the selection pressure for resistance in GPA. Regional differences in resistance levels across Australia mean that regionally relevant approaches are needed.

In developing this strategy, the latest resistance surveillance results from 2012-2013 (national) and 2014 (south-eastern Australia only) have been used. These results show that carbamate (e.g. pirimicarb), pyrethroid (e.g. alpha-cypermethrin) and organophosphate (e.g. dimethoate) resistance are now commonplace in Western Australia, South Australia, Victoria, New South Wales and Queensland grain-growing areas.

Resistance has also been found in all Tasmanian populations that have been tested, although the total number of populations screened in that state is limited. The probability of resistance to neonicotinoids (for example, imidacloprid) is assumed to increase with proximity to horticultural crops. Grain crops within 50 kilometres of a horticultural region are most likely to be at increased risk.

It is likely that the resistance status of GPA in grain growing areas is variable between seasons and regions. Although not yet widely implemented in the grains industry, appropriate management decisions for GPA should be determined after assessing early-season aphid populations (especially in years where they are anticipated to reach damaging levels).

Table 1 will help guide growers' selection of control options and potentially allow for a wider selection and rotation of chemicals in some seasons. Other general recommendations include:

- assess aphid and beneficial populations over successive checks to determine if chemical control is warranted;
- use economic spray thresholds where available;
- where GPA is colonising crop margins in the early stages of population development, consider a border spray with an insecticide to prevent/delay the build-up of GPA and to retain beneficial insects;
- avoid repeated applications of products from the same insecticide group on GPA and other pests in the same paddock;
- do not re-spray a paddock in the same season where a known spray failure has occurred using the same product or another product from the same insecticide group, or if a spray failure has occurred where the cause has not been identified;
- to encourage beneficial insects, avoid broad-spectrum sprays, particularly early in the season;
- comply with all directions for use on product labels; and
- ensure spray rigs are properly calibrated and sprays achieve good coverage, particularly in crops with a bulky canopy.

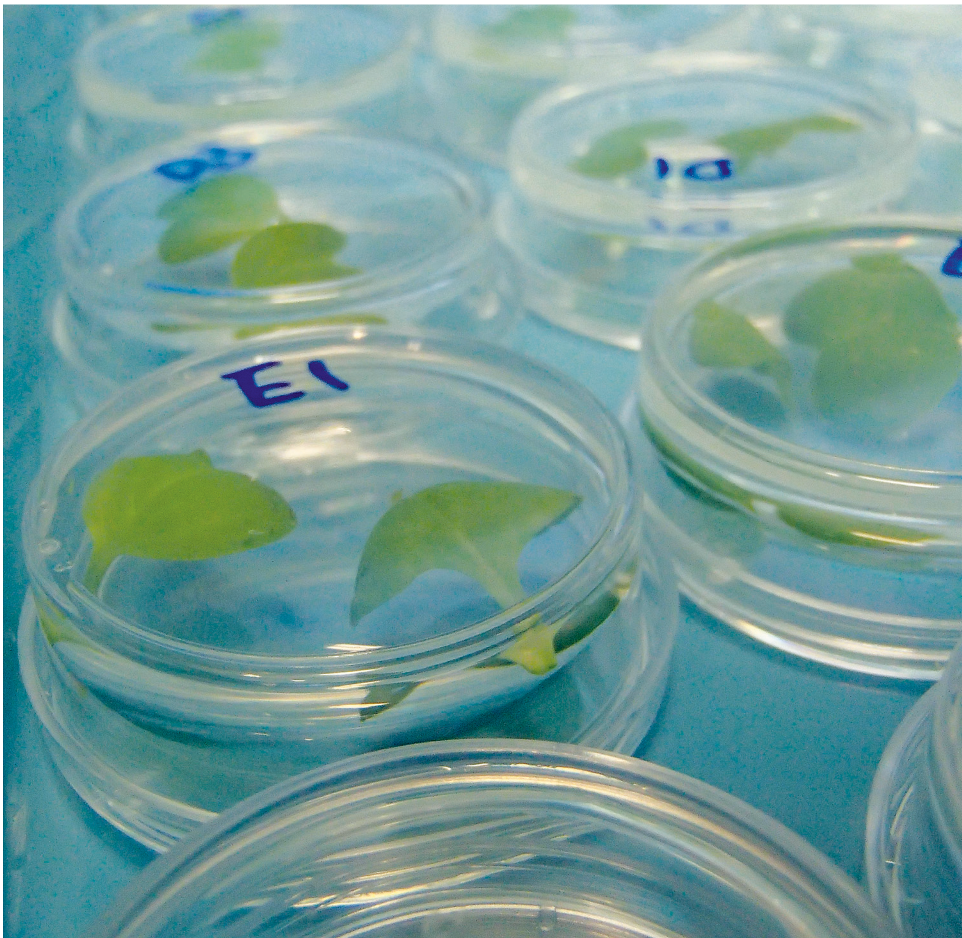

PHOTO: A. CLOUSTON (CESAR)

Insecticide resistance levels within green peach aphid populations are determined using laboratory bioassays and/or genetic testing.

Implications for resistance in other pest species

Insecticides used to control other pests will increase selection pressure on GPA if they are also present in the crop at the time of application. Similarly, insecticide applications aimed at GPA will expose other insect pests to selection pressure for resistance. Repeated chemical exposure to the same chemical group(s) should be avoided wherever possible, regardless of the pest being targeted.

- Group 1A insecticides (e.g. pirimicarb) are aphid-specific in their effects and are not effective against non-aphid pests.
- The risk of resistance developing to Group 4C (e.g. sulfoxaflor) and 4A (e.g. imidacloprid) chemicals in other pests as a result of the recommendations of this strategy is likely to be relatively low.
- The recommendation of a single application of Group 1B (e.g. dimethoate, omethoate) in some regions (where Group 1A resistance is common) is unlikely to result in significant additional risk of resistance development in other pest species.

There is industry concern that widespread and continual seed application of neonicotinoids and neonicotinoid+pyrethroid mixtures on canola will lead to unnecessary exposure of plant feeding pests to low doses of chemicals and the likely increase in resistance selection.

In many grain growing areas of southern Australia, GPA is not an annual pest, but rather a 1 in 3-to-5-year pest. It would be prudent to reserve the use of neonicotinoid-treated seed to those regions and seasons considered 'at risk' of virus transmission and/or aphid feeding damage.

TABLE 1 Grains resistance management strategy for the green peach aphid across Australia.

Crop type and location	Pre-emergence and establishment	Post establishment / pre-flowering	Rationale
Canola >50km from commercial horticultural regions	Imidacloprid (4A) or Lambda cyhalothrin + thiamethoxam (3A + 4A)	Sulfoxaflor (4C) or paraffinic oil	Carbamate (e.g. pirimicarb) resistance is commonplace. Its use is not recommended.
Canola <50km from commercial horticultural regions	Sulfoxaflor (4C)	Paraffinic oil*	Carbamate (e.g. pirimicarb) resistance is commonplace. Its use is not recommended. Neonicotinoid (e.g. imidacloprid, thaimethoxam) resistance is probably emerging in horticultural crops. Its use is not recommended.
Pulses >50km from commercial horticultural regions	Imidacloprid (4A)	Dimethoate/omethoate (1B) or paraffinic oil (Note: apply a single treatment of 1B only, do not use repeated applications. Efficacy of 1B may be reduced if insecticides have been applied previously)	Carbamate (e.g. pirimicarb) resistance is commonplace. Its use is not recommended. Organophosphate (e.g. dimethoate, omethoate) resistance is due to amplified E4 esterase, which is caused by prior exposure to organophosphates.
Pulses <50km from commercial horticultural regions	*	Dimethoate/omethoate (1B) or paraffinic oil (Note: apply a single treatment of 1B only, do not use repeated applications. Efficacy of 1B may be reduced if insecticides have been applied previously)	Carbamate (e.g. pirimicarb) resistance is commonplace. Its use is not recommended. Organophosphate (e.g. dimethoate, omethoate) resistance is due to amplified E4 esterase, which is caused by prior exposure to organophosphates. Neonicotinoid (e.g. imidacloprid, thiamethoxam) resistance is probably emerging in horticultural crops. Its use is not recommended.
All crops and areas	Biological control – improved prediction of aphid outbreak years to inform spray decisions		High risk of GPA outbreak exists when summer rainfall creates a ‘green bridge’. Warm conditions in autumn favour early aphid build-up and flights into crops. In low risk years, the prophylactic use of insecticides, such as seed treatments, can be avoided.
All crops and areas		Biological control – do not spray for GPA during or post flowering	GPA infestations after the stem elongation stage rarely cause economic yield loss in high or medium rainfall areas of the southern and western regions (with the exception of their role as vectors of virus). In lower rainfall areas or under drought conditions, yield losses can result from the combination of moisture stress and aphid damage.
All crops and areas	Cultural control –avoid sowing into paddocks with bare ground; retain stubble where possible.		Aphids are more attracted to a light open stand with bare earth visible between crop rows.
All crops and areas, except those in commercial horticultural regions and summer irrigation	Cultural control – control brassica weeds and volunteers (ideally area wide) no later than 3-4 weeks before sowing		GPA persist between growing seasons on summer and autumn weeds, particularly wild radish, wild turnip, capeweed, volunteer canola and lupins. Removing the ‘green bridge’ will reduce aphid population sizes at the beginning of the cropping season. There is likely to be a suitable ‘green bridge’ for GPA all year in the majority of horticultural and summer irrigation regions, thus there is little that can be done about weeds.

* There is an urgent need for alternative chemical control options
Note: paraffinic oils are registered for suppression of GPA only

FREQUENTLY ASKED QUESTIONS

What is the likelihood I will have a spray failure?
This will depend on past pest management practices and whether insecticide resistance is present in the target pest population. If you suspect resistance, collect a sample of the aphids and consult an entomologist or your local agronomist.

How do I prevent spray failures into the future?
Avoid the practice of 'insurance' sprays at all costs. Using the broadest range of integrated pest management (IPM) strategies is the best way to avoid future spray failures and prevent or delay the development of insecticide resistance. Make use of thresholds and spray only when absolutely necessary. Follow the guidelines outlined in Table 1, ensuring insecticides across different chemical groups are rotated within a cropping season.

What role do beneficial insects have in resistance management?
Beneficial insects that attack GPA include parasitoids (wasps) and predators (ladybirds, hoverflies and lacewings). These insects can exert good levels of control when low to moderate numbers of GPA are present, particularly during spring. Because of this, GPA should be rarely targeted with insecticides in spring, thus lowering the selection pressure for insecticide resistance. Predators and parasitoids should be encouraged as a natural way of suppressing GPA numbers. Avoid the use of unnecessary insecticide applications and monitor trends in beneficial populations before making a spray decision.

USEFUL RESOURCES

Science behind the resistance management strategy for the green peach aphid (*Myzus persicae*) in Australian grains – 2014

www.ipmguidelinesforgrains.com.au/ipm-information/resistance-management-strategies

Green peach aphid – PestNote
www.cesaraustralia.com/sustainable-agriculture/pestnotes/insect/green-peach-aphid

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This strategy was developed by the National Insecticide Resistance Management (NIRM) working group of the Grains Pest Advisory Committee, a GRDC-funded project which provides strategic advice to GRDC on pest issues. NIRM, chaired by Dr Paul Umina, is responsible for developing insecticide resistance management strategies for a number of grain pests. The group's representative membership ensures engagement of agro-chemical industries, researchers, advisers and CropLife Australia.

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