NURSERY PAPERS
JULY 2019

NEONICOTINOID INSECTICIDES – NO REPLACEMENTS BUT THERE ARE ALTERNATIVES

INTRODUCTION

Neonicotinoid (Neonic) insecticides have been an important chemical tool to manage pests in Australian production nurseries for more than twenty years, with imidacloprid (e.g. CONFIDOR) the most recognised neonic used in horticulture.

With global concerns mounting over the unintended impacts from this class of insecticide, including its potential impact on bees and the move from a large retailer to prohibit the use of such products in stock it sells, Nursery & Garden Industry Australia (NGIA) and Hort Innovation commissioned an assessment report.

In this Nursery Paper, we extract the key findings of the report '*A review of external influences on the availability of neonicotinoid and other pesticides to the Australian Nursery Industry*' (NY17009) and outline the strategies applied globally to compensate for the removal of neonics in horticulture.

Summary

- There is no evidence that neonic insecticides are impacting on bees or any other aspect of our natural environment in Australia at a level higher than any other class of insecticide.
- There are no 'replacement' insecticides, particularly for imidacloprid, based on availability, cost, pest efficacy and systemic activity, however there are 'alternative' insecticides that can be introduced into cropping systems.
- NGIA, through funding from Hort Innovation, has been managing the pesticide minor use permit (MUP) program since 2008, the bulk of available alternative non-neonic insecticides present in Australia are registered in nursery stock through the MUP scheme.
- New active ingredients available for use under MUP's include chemistry that is more modern and target specific, with a narrower pest range compared to common neonics in use. The cost difference per litre can be 13 times higher.
- To adopt the alternative insecticides into a pest management program, growers will need to support pesticide application decisions through good crop data, including pest monitoring and an integrated plant protection system.

BACKGROUND

Production nurseries have access to a suite of pesticides (fungicides, insecticides, herbicides etc.) to manage the diverse range of plant pests (diseases, insects, weeds etc.) that can impact on the extensive range of plants they produce.

The majority of modern pesticides available to production nurseries are via the Australian Pesticides and Veterinary Medicines Authority (APVMA) minor use permit (MUP) program. MUP's legally approve the use of pesticides on a crop not covered by the registered product label, in Australia.

In 2018, a major Australian greenlife retailer announced that they would no longer be selling plants exposed to neonics from 2020 onwards, a decision based on claimed concerns around neonics and their potential impacts on bee populations.

Such neonic insecticides are currently legally available to Australian production nurseries to control a wide range of important insect pests. In 2014, the APVMA stated they had no evidence that neonic insecticides were affecting these same bee populations.

Internationally, there are bans on neonic insecticides in Canada and the EU, with indications that the UK and USA will have the same regulations by 2020. Domestically, some see that prohibiting the use of neonics in Australia could severely impact on pest management strategies and give rise to more toxic and older chemicals.

The most concerning class of old chemistry likely to be re-introduced is the organophosphates and carbamates with broad-spectrum insecticidal activity,

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This communication has been funded by Hort Innovation using the nursery research and development levy and contributions from the Australian Government.
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which have negative impacts on beneficial insects, longer environmental fate and high mammalian toxicity for animals and humans.

The aim of this research into neonics is to provide information to growers on accessible non-neonic insecticides. It also looks at current restrictions on neonic insecticides and identifies alternatives available through the MUP program, and highlights future chemicals that may become available.

THE RESEARCH

Neonics are a unique group of synthetic pesticides with six different actives registered in Australia: acetamiprid, clothianidin, dinotefuran, imidacloprid, thiacloprid and thiamethoxam.

Neonics control insects by acting on their central nervous system and blocking nicotinic acetylcholine receptors. This prevents impulses being transmitted between nerves, which leads to the paralysis and eventual death of the insect. The insecticides can be applied as a foliar treatment, soil drench or seed treatment.

Neonic insecticides work by contact with and via the stomach (ingestion of plant material) of the insect. All neonic insecticides are systemic within plants moving up through the xylem within the treated plant. Treated plants transport the compound throughout the leaves, flowers (pollen and nectar), roots and stem.

They are effective against many important agricultural pests, such as sucking insects (aphids, leafhoppers, mealy bugs, mirids, psyllids, scale, thrips, whitefly), chewing insects (beetles, borers, bugs, canegrubs, weevils), as well as some soil insects (fungus gnat, scarabs) and ants.

Several overseas countries began imposing restrictions on some of the neonics from as early as 2008 due to environmental concerns. The first was Germany's restriction on clothianidin following bee deaths in corn. In 2013, the EU and several non-EU countries restricted the use of certain neonicotinoids (clothianidin, imidacloprid and thiamethoxam) for two years on all seed treatment uses, which has since been extended.

This year, the EU will phase out clothianidin, imidacloprid and thiamethoxam for all outdoor uses.

Several US states have also restricted the use of neonics out of concern for pollinators and bees. At the time of undertaking this review (April 2019), there were no restrictions placed on the use of neonics by the APVMA in Australia.

IMPLICATIONS FOR THE NURSERY INDUSTRY

The research identified that NGIA's MUP program has ensured the majority of new non-neonic alternative pesticide actives in Australia are available to the nursery industry via multiple MUPs. The following table (**Table 1**) lists a range of pesticide alternatives to imidacloprid:

***TABLE 1:** List of current available insecticide alternatives to imidacloprid*

Insect pest	Alternative insecticide	Permit number
Aphids	Alpha-cypermethrin, Diafenthiuron, Petroleum oil, Pymetrozine, Spirotetramat	PER81707
	Flonicamid	PER83964
	Pirimicarb	PER84735
	Sulfoxaflor	PER85011
Ants	Fipronil	PER81707
	Chlorpyrifos	PER85259
Fungus gnats	Bacillus thuringiensis, Fipronil, Pyriproxyfen	PER81707
	Cyromazine	PER83506
Lace bugs	Nil	
Mealy bugs	Buprofezin, Fipronil, Spirotetramat	PER81707
	Flonicamid	PER83964
	Sulfoxaflor	PER85011
Psyllids	Abamectin, Bifenthrin, Methomyl	PER84229
	Azadirachtin, Chlorpyrifos, Methomyl	PER84953
Scales	Buprofezin, Fenoxycarb, Petroleum oil, Spirotetramat	PER81707
	Sulfoxaflor	PER85011
Scarab beetle larvae	Fipronil	PER81707
Whiteflies	Buprofezin, Diafenthiuron, Pyriproxyfen, Pymetrozine, Spirotetramat	PER81707
	Flonicamid	PER83964
	Sulfoxaflor	PER85011
	Dimethoate	PER86930

In **Table 1**, the insecticide in red is the most likely alternative to imidacloprid, based on the number of pests the product can treat. As of June 2019, the cost per litre for imidacloprid was around $20 and $160 for spirotetramat, with the latter almost 13 times more expensive. It is vital that a sound rotation program is in place (minimum of 3 different actives from 3 different mode of action groups) when using alternative actives to reduce the risk of pest resistance.

Table 2 lists non-neonic insecticides registered and available for production nurseries to use based on specific plant pests. A high number of these registered insecticides are within the 1A or 1B Mode of Action Groups, carbamates and organophosphates, which are under active review by the APVMA therefore availability may be limited in the future.

TABLE 2: Registered Non-Neonic Actives for Containerised Plants

Insect pest	Alternative insecticide	Trade Name (Mode of Action Group)	Registered crops
Ants	Hydramethylnon	Amdro Ant Bait (Group 20A)	Nursery stock (non-food)
	Metaflumizone	Siesta Ant bait	Nursery stock (non-food)
Beetles	Carbaryl	Carbaryl (Group 1A)	Ornamentals
Borers	Carbaryl	Carbaryl (Group 1A)	Ornamentals
Fungus gnats	diazinon	Diazinon (Group 1B)	Ornamentals
Lace bugs	Dimethoate	Danadim (Group 1B)	Ornamentals
	Esfenvalerate	Sumi-alpha (Group 3A)	Ornamentals (outdoor)
	Maldison	Fyfanon (Group 1B)	Ornamentals and flowers
Leafhoppers	Dimethoate	Danadim (Group 1B)	Ornamentals
	Esfenvalerate	Sumi-alpha (Group 3A)	Ornamentals (outdoor)
Mealy bugs	Bifenthrin	Compel Pro (Group 3A)	Ornamentals
	Potassium salts of fatty acids	Natrasoap (biological)	Ornamentals
Mirids	Dimethoate	Danadim (Group 1B)	Ornamentals
	Phorate	Thimet (Group 1B)	Ornamentals
Psyllids	Dimethoate	Danadim (Group 1B)	Ornamentals
Scales	Carbaryl	Carbaryl (Group 1A)	Ornamentals
	Maldison	Fyfanon (Group 1B)	Ornamentals and flowers
	Paraffinic oil	Bioclear (oil)	Ornamentals
	Petroleum oil	Biocover (oil)	Ornamentals

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TABLE 2: Registered Non-Neonic Actives for Containerised Plants (continued)

Insect pest	Alternative insecticide	Registration (chemical group)	Registered crops
Scarab beetle larvae	Chlorpyrifos	Chlorpyrifos (Group 1B)	Ornamentals (potted)
	Dimethoate	Danadim (Group 1B)	Ornamentals
Thrips	Beauveria bassiana	Broadband (biological)	Protected ornamentals
	Bifenthrin	Compel Pro (Group 3A)	Ornamentals
	Dimethoate	Danadim (Group 1B)	Ornamentals
	Esfenvalerate	Sumi-alpha (Group 3A)	Ornamentals (outdoor)
	Phorate	Thimet (Group 1B)	Ornamentals
	Potassium salts of fatty acids	Natrasoap (biological)	Ornamentals
	Spinetoram	Success Neo (Group 5)	Ornamentals
Whiteflies	Beauveria bassiana	Broadband (biological)	Protected ornamentals
	Bifenthrin	Compel Pro (Group 3A)	Ornamentals
	Dimethoate	Danadim (Group 1B)	Ornamentals
	Emulsifiable botanical oil	Eco-Oil (oil)	Ornamentals, nursery & greenhouse tomatoes/flowers
	Paraffinic oil	Bioclear (oil)	Ornamentals
	Petroleum oil	Biocover (oil)	Ornamentals
	Potassium salts of fatty acids	Natrasoap (biological)	Ornamentals
	Pymetrozine	Chess (Group 9B)	Nursery stock (non-food)
	Pyriproxyfen	Admiral (Group 7C)	Nursery stock

While APVMA has no plans to restrict the use of neonic insecticides in the nursery industry or for any other agricultural use at the time of this report, we note that overseas trends tend to be indicative of future Australian trends. As such, there is value in finding alternatives to neonics to keep in line with overseas requirements.

As of June 2019, there were no government bans in place for using neonic insecticides. Production nurseries supplying the national greenlife retailer, from 2020, will not be allowed to use neonic insecticides on products going into this supply channel unless required as a quarantine treatment.

The only non-neonic use pattern that is not covered by alternative insecticides, is that which is under the MUP – PER85010 – Spinner Turf (cyantraniliprole + thiamethoxam) / nursery stock (non-food) and fruit trees (non-bearing) / African black beetle, scarab beetle larvae, chafer beetle larvae and stem weevil larvae, used as a soil drench.

The report identified a number of additional actives that NGIA should pursue under the MUP program with three selected and will be under application with APVMA by the end of 2019.

Photo Credit: Sara Pavic

AgAware Consulting Pty Ltd conducted the report, which forms part of the NGIA-led project *'Improving Pest Management in the Nursery Industry'* (NY17009) funded by Hort Innovation using nursery industry levies and funds from the Australian Government.

MORE INFORMATION:

- *A review of external influences on the availability of neonicotinoid and other pesticides to the Australian Nursery Industry.* ***www.nurseryproductionfms.com.au/pesticides***
- *Minor Use Permits for pesticides:* ***http://nurseryproductionfms.com.au/minor-use-permits-mups-for-pesticides/***
- *Further information: NGIA National Biosecurity Manager John McDonald on* ***john.mcdonald@ngia.com.au***

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