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Protecting honeybees from pesticide poisoning

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A cross–industry concern

With the ongoing concern about the impact of pest insects in southern grains this year, and hence the increased use of insecticides, there may be a large unintended consequence this spring – significant losses in the honeybee industry which will lead to similar losses in pollination of oilseed and horticultural crops, particularly almonds. In the extreme case of almonds, no bees means no crop at all.

During cold winter months, bees have relatively low food reserves. When crops (particularly canola) commence flowering, honeybees are moved in to exploit an excellent source of nectar and pollen, and to pollinate the crop. In August, hundreds of thousands of hives are moved into almond orchards, and other horticultural tree crops, where they play a critical pollination role. This mostly occurs in late August-early September onwards.

The accidental poisoning of bees can cause the collapse of numerous bee colonies, and with them, the loss of pollination services to both grains and horticultural industries. This is devastating to beekeepers trying to make a living from honey production and/or paid pollination services. The importance of bees in pollinating canola is well known, but a recent article on Ground Cover Radio highlights how bees also improve the yields of pulses, particularly faba beans.

Foraging habits of honeybees

Bees are active over temperatures ranging from about 13° to 37°C, with an optimum from 19° to 30°C. When temperatures allow, they can be active from about 8 am to 4 pm. In late winter and early spring, most foraging occurs between 10 am and 3 pm when temperatures are above about 15°C. Bees typically forage within 2-4 km of their hive, but they may travel over 8 km in search of pollen and nectar when nearby pollen and nectar sources are in short supply or are of poor quality. Because flowering canola is so attractive to honeybees, it is highly likely that bees from hives situated many kilometres away will be foraging canola when temperatures exceed 15°C.

Pesticides hazardous to bees

Most insecticides registered in Australia for oilseed and pulse crops will kill honeybees. The registered carbamates (except pirimicarb) (Group 1A), organophosphates (Group 1B), synthetic pyrethroids (Group 3A), neonicotinoids (Group 4A), sulfloxaflor (Group 4C), spinetoram (Group 5), emamectin benzoate (Group 6), and indoxacarb (Group 22A) are either toxic or highly toxic to honeybees after direct contact with spray or dust. We exclude reference to seed treatment insecticides due to on-going research into their sub-lethal effects on honeybees. No other insecticides are registered

or permitted for use in canola and pulse crops under the legislation of most States or Commonwealth.

Some surfactants are also toxic to bees and when mixed and sprayed with bee-safe chemicals can cause bee poisoning. In Australia, surfactants and other adjuvants are regarded as pesticides in their own right.
Some insecticides such as *Bt* (Bacillus thuringiensis), NPV (nuclear polyhedrosis virus) and pirimicarb have a relatively low impact on bees.

Pesticides known to be hazardous to bees generally contain a warning on the label under Protection of Livestock (see Appendix to this link for specific label warnings). This is a mandatory instruction – '*DO NOT spray any plants in flower whilst bees are foraging*'. This applies to both the target crop and any flowering weeds throughout the target crop and/or within the surrounding headland buffer zone. This means that in most instances, spraying insecticides on canola whilst in flower during daylight where temperatures exceed 12-15°C could be both illegal and potentially hazardous to bee hives within 7 km.

The pesticide risk
Honeybee poisoning may occur when:

- a chemical is applied directly to a flowering crop while bees are foraging
- a chemical is applied to a crop that is flowering, and bees subsequently forage on contaminated nectar, pollen or water, or land on a contaminated plant part.
- a chemical is applied to a crop not in flower, but is also applied to non-target plants that are flowering (e.g. weeds), at the same time
- pesticide drifts onto bees, flowering plants, hives or the bees' water source.
- a worker bee carries contaminated nectar, pollen or water back to the hive, contaminating the colony
- an area within the bees' flight path is sprayed
- two or more pesticides are combined , which although "bee safe" in their own right, may be harmful to bees when mixed.

Opportunities to reduce the risk of honeybee poisoning

- Contact the owners of any beehives in the area well before spraying, so they have an opportunity to relocate or protect their hives. Include owners of hives on adjacent properties, bearing in mind that bees commonly forage large distances, and move between and across different properties.
- Beekeepers require as much notice possible, *at least* 48 hours, to move hives. (please consider that beekeepers may live quite some distance from the hives and they generally need to wait for nightfall to start moving the hives).
- If using spray contractors, inform them of the location of any hives that may be affected and ensure that they understand the importance of reducing the risk of honeybee poisoning.

- In NSW and Queensland, the Bee Alert (www.cottoncrc.org.au/industry/Tools/Bee_Alert.) program logs the location of some hives. Not all hives are logged via this system.
- Read and comply with the product label. Understand the *residual risk* to bees. *Microencapsulated* forms of pesticides have significantly longer *residual toxicity* than other forms.
- Prior to spraying, ensure that bees are not foraging in the target area. This is a condition of many product labels and is therefore a legal requirement. Monitor the target crop and area to determine: (a) presence of flowering plants in the target crop, including the target crop and/or weeds throughout the target crop and/or within the surrounding headland buffer zone; and (b) presence of honeybees on flowering plants at 4 locations including those close to native vegetation, areas of flowering weeds, the edge of the crop and some distance into the crop.
- If using pesticides that are toxic to bees,, apply them in the evening when bees are not foraging.
- Choose appropriate spraying conditions so as to reduce the chance of spray drift affecting non-target flowering crops, hives, and water sources. Use a kestrel anemometer to measure wind speed rather than estimating it. *Spray drift has been responsible for some of the biggest hive losses in recent years – keep this in mind when planning to spray*.
- Select chemicals that pose a low risk to bees, whilst still achieving the required outcome for the crop. Keep in mind that by definition insecticides are poisonous to bees and many other agricultural chemicals can have detrimental effects on them.
- Different chemicals vary in the period of residual toxicity. Bees should not be moved into a crop that was treated pre-flowering until the residual toxicity has dissipated. Similarly, bees moved from an area to be treated should not be returned until it is safe to do so.

Information sources:

Cotton Pest Management Guide 2013-14
http://www.crdc.com.au/publications/cotton-pest-management-guide-2013-14
Russell Goodman - Senior Officer – Apiculture, Vic DEPI (Melbourne)
Don McCaffery – Technical Specialist, NSW DPI (NSW Central Tablelands)
NSW Apiarists' Association
RIRDC 2012. Honeybee Pesticide Poisoning - A risk management tool for Australian farmers and beekeepers
https://rirdc.infoservices.com.au/items/12-043
Michael Stedman (Biosecurity SA) - Canola, Insecticides and Honeybees – Spring 2014 Canola, insecticides and honeybees: grower awareness - Spring 2014.
http://www.pir.sa.gov.au/biosecuritysa/animalhealth/other_animals/bees

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Appendix

Insecticide Labels and bees (Under "Protection of Livestock")

Below is a list of the honeybee-related label statements on most (but not all) product labels for commonly used active ingredients.

Chlorpyrifos (500g/L); Imidacloprid (200g/L); Omethoate (290g/L) Dangerous to bees. DO NOT spray any plants in flower where bees are foraging.

Alpha-cypermethrin (100g/L) Dangerous to bees. DO NOT spray any plants in flower while bees are foraging. This product is known to have deterrent effect on foraging bees for a short period of time after spraying. Risk to bees is reduced by spraying in the early morning and late evening when bees are not foraging.

Bifenthrin (100g/L) Dangerous to bees. DO NOT spray any plants in flower while bees are foraging. Spray in the early morning when bees are not actively foraging.

Clothianidin (200g/L) Dangerous to bees and will kill bees foraging in the crop to be treated or in hives which are oversprayed or reached by spray drift, and residues may remain toxic to bees several days after application. Toxic to bees for several days after application. Used on eucalypt seedlings to 1 year old.

Dimethoate (400g/L) Dangerous to bees. DO NOT spray any plants in flower while bees are foraging. Some repellent effect may be apparent for approximately 2 days

Emamectin benzoate (17g/L) Highly toxic to bees. Will kill bees foraging in the crop to be treated or in hives which are overs-prayed or reached by spray drift. Residues may remain toxic to bees for several days after application. DO NOT spray any plants in flower while bees are foraging. Before spraying, notify beekeepers to move hives to a safe location with an untreated source of nectar, if there is potential for managed bees to be affected by the spray or spray drift.

Indoxacarb (150g/L) Dangerous to bees. DO NOT apply when bees are actively foraging. Avoid direct application or drift of the spray mix onto beehives. After the spray has dried, bees can safely forage flowering crops.

Lambda-cyhalothrin (250g/L) Toxic to bees. DO NOT spray when bees are actively foraging. Risk is reduced by spraying in the early morning or late evening.

Spinetoram (120g/L) This product is highly toxic to bees; will kill bees foraging in the crop to be treated or in hives which are oversprayed or reached by spray drift. Residues may remain toxic to bees for several days after application.

Spinetoram (250g/kg) Bee safety: Delegate is dangerous to bees and will kill bees foraging in the crop being treated or in hives which are oversprayed or reached by spray-drift. Once the spray deposit has dried, foraging bees should not be affected when using spray volumes of 2000 L/ha or less. However, if using spray volumes greater than 2000 L/ha, it is possible that foraging bees may be affected for some days after spraying.

Sulfoxaflor (240g/L) Highly toxic to bees. Will kill foraging bees directly exposed through contact during spraying and while spray droplets are still wet. May harm bees in hives which are over-sprayed or reached by spray drift. DO NOT apply this product while bees are foraging in the crop to be treated. Risk Management: Treatment made in crops in flower or upwind of adjacent plants in flower that are likely to be visited by bees at the time of application, should not occur during daytime if temperatures within an hour after the completion of spraying are expected to exceed 12°C. It is recommended that orchard floors containing flowering plants be mown just prior to spraying. Beekeepers who are known to have hives in, or nearby, the area to be sprayed should be notified no less than 48 hours prior to the time of the planned application so that bees can be removed or otherwise protected prior to the spraying.