Appendix C

Bees

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INTRODUCTION

The general protection goal is to protect biodiversity and ecosystems. The protection goal for bees aims to protect survival and development of colonies, and limit effects on larvae and bee behaviour. In addition, abundance/biomass and reproduction are considered because of their importance for the development and long-term survival of colonies.

The viability of each colony, the pollination services it provides, and its yield of hive products all depend on the colony‘s strength and, in particular, on the number of individuals it contains. Therefore, protection goals are related specifically to colony strength (colony size). The magnitude of effects on colonies should not exceed 7% reduction in colony size. Foragers’ mortality should not be increased compared with controls by a factor of 1.5 for six days or a factor of 2 for three days or a factor of 3 for two days.

Honey production is important for beekeepers and it is expected that honey production is covered by the protection goals for colony development and forager mortality.

USES THAT DON'T REQUIRE ASSESSMENT

The most important route of exposure of honeybees to pesticide products is by direct exposure to field sprays. In some cases, exposure of bees is not possible and there is no need for a detailed assessment of risks. Examples are: use during winter when bees are not flying; pre-emergence use of herbicides, indoor use and use in glasshouses where bees are not used for pollination; seed treatments and granules except when there is systemic activity; products for dipping bulbs, etc. However, any crops in which there are flowering weeds, or which might be overflown by bees visiting other crops, may present a risk of exposure, even if the crops themselves are not attractive to bees. In such cases, it is prudent to regard exposure as possible and to continue with the assessment.

Toxicity values

Adults:

- acute contact LD_{50} : (OECD guideline 214)
- acute oral LD_{50}: (OECD guideline 213)
- chronic oral NOEL: (OECD guideline 245).

Larvae:

- acute oral LD_{50}: (OECD guideline 237)
- chronic oral NOEL: (OECD Series on Testing & Assessment No. 239).

Systemic products

For soil-applied products (eg seed dressing) the oral toxicity of the active substance(s) have to be determined. If potential risks to honeybees are identified, realistic exposure conditions should be taken into account, ie realistic exposure concentrations as expected in nectar and pollen as indicated by residue studies. If a risk is indicated, higher tier studies (cage/tent/tunnel or field studies) with realistic exposure scenarios should be performed.

Residual toxicity

Residual toxicity information can be used to determine whether a product can be used during bloom, but when bees are not actively foraging. While bees may forage over a broad range of temperatures and environmental conditions, honey bees tend to forage during specific times when flowers are prone to releasing pollen and/or nectar; foraging for pollen or nectar generally does not begin until temperatures reach 12–14ºC, and forage flights are generally correlated with greater light intensity (Winston 1987). While not always the case, such conditions tend to occur during the day but after the early morning hours and before the late evening hours.

Residual toxicity data are generated through the 'toxicity of residues on foliage test' (OCSPP 850.3030) and are referred to as RT_{25} data. RT_{25} is the length of time post-application that residues on foliage are toxic to 25% of honey bees tested. RT_{25} values are a function of a number of factors including application rate, physical-chemical properties, dissipation, crop, and pesticide formulation. Thus, there is considerable variability in RT_{25} values within a single formulation, between formulations, between crops, and across application rates. USEPA (2017) believes

that a product with an RT_{25} value of six hours or less could be used during bloom provided the application window starts two hours prior to sunset and eight hours prior to sunrise.

Higher tier tests

For higher tier testing (cage/tent/tunnel or field trials), the recommendations of EPPO guideline 170 should be taken into account.

Metabolite testing

Standard lab tests are normally not required for metabolites. Exceptions may be cases where, for example, the metabolite is the pesticidal active molecule. If higher tier studies (cage/tent/tunnel or field) are conducted with the product under realistic exposure conditions, potential risks from metabolites should be covered.

RISK ASSESSMENT

The acute and chronic risks to bees are assessed using a tiered approach, which is in line with current APVMA (2017) guidance. For the assessment, a regulatory acceptable dose (RAD) is first calculated for acute and chronic exposure scenarios as indicated in Table C1. A screening level risk assessment then assumes the worst-case scenario of a direct overspray of blooming plants that are frequented by bees in order to identify those substances and associated uses that do not pose a risk (Table C2).

For systemic products, exposure considerations and calculations should be based on the active constituent present in the respective plant parts (eg nectar, pollen) to which honeybees could be exposed. However, it should be noted that estimates of these concentrations are rarely available.

If a refined assessment is necessary, the attractiveness of the crop plant to honeybees may be considered. Useful guidance in this respect may be found in EFSA (2013), Appendix D and USDA (2017). There are also recommendations on additional criteria to consider, such as the presence in the foraging area of other sources of nectar/honeydew of higher/lower level of attractiveness, ie weeds, which may influence the behaviour of bees towards the crop of interest. In general, a crop can be considered as unattractive to bees when it is harvested before flowering. Some plants that are intrinsically not attractive to bees may be visited due to extra floral nectaries, eg in field beans, or due to honeydew produced by aphids on crops otherwise not attractive to bees. Similarly, the presence of bee-attractive flowering weeds or of ‘secondary’ crops (eg associated flowering crop, mixed cropping, intercropping) in an unattractive crop may result in bee activity that leads to some exposure. A description of agricultural practices associated to the crop of concern may help in deciding whether or not visits and exposure are to be expected.

Systemic products

The exposure of honeybees to pesticide products used for soil or seed treatments may occur in the case of transfer of the active constituent itself, or its degradation products, to the parts of the plant that may be consumed by bees, ie nectar, pollen or honeydew. Exposure to contaminated honeydew is not considered a relevant route in the case of soil and seed treatments. This is because the concentration of a systemic compound that could circulate in the phloem and reach honeydew without harming aphids should, in principle, not be capable of harming bees foraging on the honeydew, unless the compound is highly selective towards non-aphid insects.

Information derived from residue studies and plant metabolism studies is, in general, sufficient to identify if the substance is transferred into the plant during its growth, and if it is further degraded into major degradation products. Similarly, possible uptake in plants of major soil degradation products will be identified in these residue studies. The plant protection product is considered systemic in case of uptake and transfer into the plant.

RISK ASSESSMENT TABLES

Table C 1 Regulatory acceptable doses for bees

Life stage	Exposure	Endpoint (µ ac/bee)	Assessment factor	RAD (µ ac/bee)
Adults	Acute contact	LD_{50} XX	2.5	
	Acute oral	LD_{50} XX	2.5	
	Chronic oral	NOEL XX	1	
Larvae	Acute oral	LD_{50} XX	2.5	
	Chronic oral	NOEL XX	1	

Assessment factors as per APVMA roadmap for pollinator assessment (APVMA 2017)

RAD = Regulatory Acceptable Dose = endpoint / assessment factor

Table C 2 Screening level assessment of risks to bees

Life stage	Exposure	Application rate (g ac/ha)	Predicted total dose (µ ac/bee)	RAD (µ ac/bee)	RQ
Adults	Acute contact				
	Acute oral				
	Chronic oral				
Larvae	Acute oral				
	Chronic oral				

Cumulative application rate is based on maximum single application rate, number of applications, interval between applications and default DT_{50} 10 days

Predicted total dose calculated using USEPA BeeREX tool for adult worker bee foraging for nectar and larval drone within the hive

RAD = Regulatory Acceptable Dose from Table C1

RQ = risk quotient = Predicted total dose/RAD, where acceptable RQ <1

RISK MITIGATION AND LABELLING

If the adult acute oral and/or contact LD_{50} values are <0.1 ug ac/bee, then the following hazard statement is required under the heading 'PROTECTION OF HONEY BEES AND OTHER INSECT POLLINATORS'.

- highly toxic to bees.

If the LD_{50} value is ≥0.1 ug ac/bee and <1.0 ug ac/bee, then the following statement applies:

- toxic to bees.

If the LD50 value is ≥1.0 ug ac/bee and <10 ug ac/bee, then the following hazard statement applies:

- moderately toxic to bees.

For systemic compounds that are expected to result in detectable residues in pollen & nectar, the following statement is required.

- (active) has a systemic action.

When bee brood RQ >1:

- harmful to bee brood.

When hazard or systemic action identified but screening level RQ ≤1:

- however, the use of this product as directed is not expected to have adverse effects on bees.

For soil-applied products for which a hazard statement is required, the following statement is also required:

- avoid application by surface drippers or micro sprinklers while bees are foraging, especially on hot days as bees can use these devices as sources of water for the hive.

Mitigating risks due to contact toxicity

Generally, residual toxicity data are necessary at a minimum to mitigate risks of contact toxicity. When (acute RQ >1 and RT_{25} >6 hours) or (bee brood RQ >1), then it is not advised that the product be applied during bloom:

- DO NOT apply to crops from the onset of flowering until flowering is complete. DO NOT allow spray drift to flowering weeds or flowering crops in the vicinity of the treatment area. Before spraying, notify beekeepers to move hives to a safe location with an untreated source of nectar and pollen, if there is potential for managed hives to be affected by the spray or spray drift. Residues may remain at levels toxic to bees for X days[1] following application.

[1] In absence of data, X can be estimated: ln (adult contact LD_{50} in µg ac/bee × 0.17 / application rate in kg ac/ha) / (-ln2/foliar DT_{50} in days)

When acute RQ >1 and RT_{25} ≤6 hours, the product can be safely applied at night when bees are not actively foraging:

- DO NOT apply to crops from the onset of flowering until flowering is complete unless the application is made in the time period between two hours prior to sunset and 8 hours prior to sunrise. DO NOT allow spray drift to flowering weeds or flowering crops in the vicinity of the treatment area. Before spraying, notify beekeepers to move hives to a safe location with an untreated source of nectar and pollen, if there is potential for managed hives to be affected by the spray or spray drift.

The above statements would not be required if higher tier semi-field or field studies demonstrate they are not necessary. Product-specific statements can be developed based on the outcome of higher tier studies and the specific concerns identified.

Mitigation risks due to oral toxicity

Please refer to APVMA (2017) for additional guidance on risk mitigation and labelling.

REFERENCES

APVMA (Australian Pesticides and Veterinary Medicines Authority), 2017*, Roadmap for insect pollinator risk assessment in Australia*, ISBN 978-1-925390-00-1, available online: www.apvma.gov.au/node/27551.

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