2.4 A bee brood study with relevant test concentrations using glyphosate as an example

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Abstract

To address European Union data requirements for plant protection products, honey bee risk assessments are required where exposure of adults and larvae via direct contact or from residues in nectar and pollen cannot be excluded. Acute oral and contact toxicity studies are performed on adult bees and registrants may also be required to conduct Tier 1 larval or adult chronic toxicity studies for which an OECD guidance is still under development or Tier 2 colony-level brood effects studies.

For EU re-registration of the active substance glyphosate, potential exposure and effects, on honey bee brood/colonies were assessed in separate studies. To quantify exposure, a greenhouse study involved a spray application of a glyphosate formulation to flowering *Phacelia tanacetifolia* during peak bee foraging. Glyphosate concentrations over time in forager-collected pollen and nectar were analysed. Mean glyphosate levels in pollen exceeded by more than an order of magnitude the residues in nectar, and declined rapidly with average concentrations declining to half of the initial concentration within one to two days (DT_{50}=1-2 days). Pollen and nectar residue values were used as inputs to a bioenergetics-based exposure model to establish realistic worst case dose levels. To quantify effects on brood/colonies, a Tier 2 bee brood feeding study was performed using the Oomen test design. Colonies were tested at four dose levels including the control. Colonies were assessed 1 week prior and weeks 1, 2 and 3 after dosing. Assessments tracked development of individual larvae and emergence, and the health of the colony as a whole with exposure confirmed by residue analysis of larvae collected from within the colony, confirming the validity of the in-hive portion of the bioenergetics model. No effects at any dose level consequently the No Observed Effect Level for brood development and adult survival was the highest dose tested, providing a sufficient margin of safety on the risk of glyphosate to honey bees. This conclusion is consistent with results of independently performed semi-field and field bee brood studies using a glyphosate-based formulation. Since many insecticide classes have already been tested at field-relevant concentrations in large-scale field studies or tunnel tests, the proposed dose-setting and testing methodology can be considered effective and valuable for substances where realistic test concentrations have not been determined, and only acute data are currently available, which is typically the case for many herbicides and several classes of fungicides.

Reference

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Evaluating exposure and potential effects on honeybee brood (Apis mellifera) development using glyphosate as an example.
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