# Laboratory Assessment of Pesticide Hazards to Honey Bees and non-Apis Bees

# Lab - Hazard Team

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## Lab-Hazard Chapter Sections

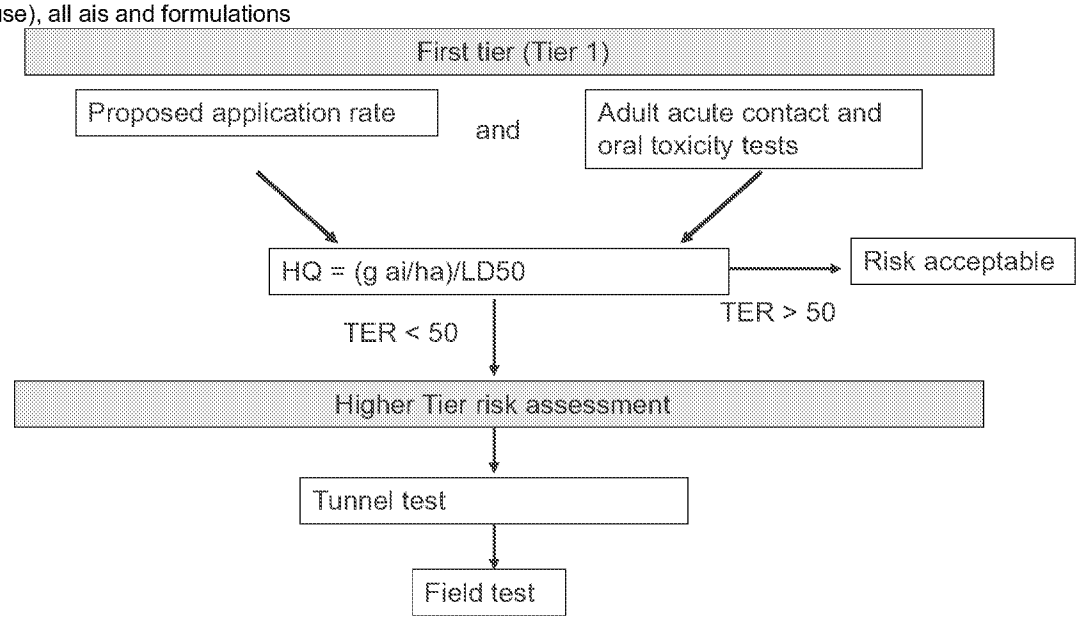
- Harmonizing of Well Developed Tier 1 Tests
- New Candidate Tier 1 & 2 Tests for Adoption
- Methods Requiring Further Development for Tier 1 & 2 through High Priority Research

# Harmonizing of Well Developed Tier 1 Tests

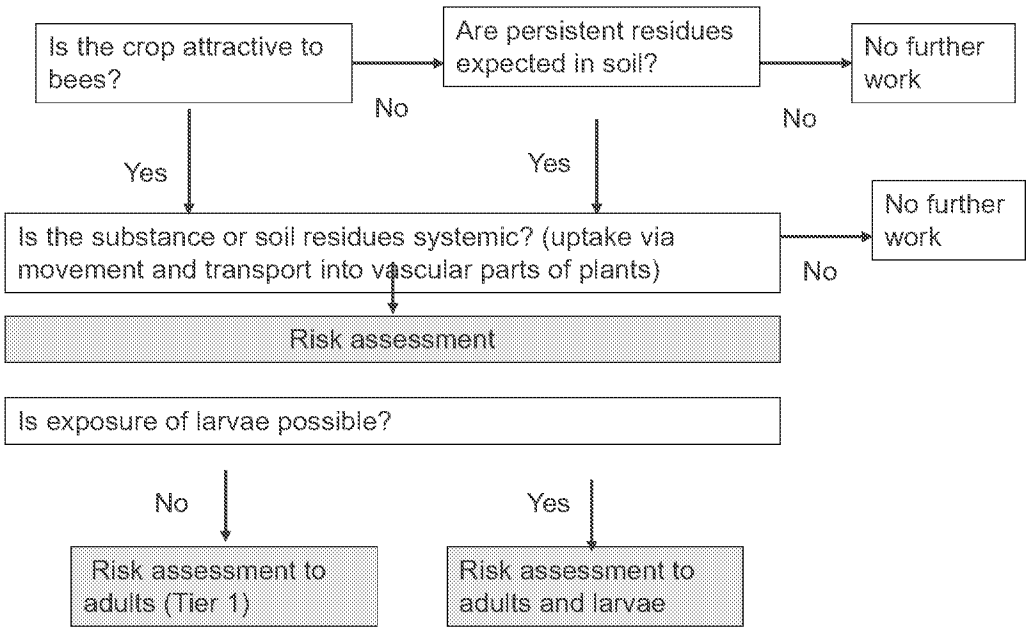
- Separate Tier 1 scheme for sprayed vs. seed/soil chemicals
- Adult contact $LD_{50}$ for sprayed AI's and Formulation Ingredients tested in parallel
- Recommend adoption of Acute contact and oral $LD_{50}$ tests for adult bees using protocols of OECD 213 and 214 (EC 1107/2009)
- Countries wishing immediate addition for larval oraL testing can use Oomen et al. 1992 (OECD 76) until final protocol for larval feeding based on modified Aupinel method is adopted

# Recommended Tier 1 Sprayed Pesticides - Adults

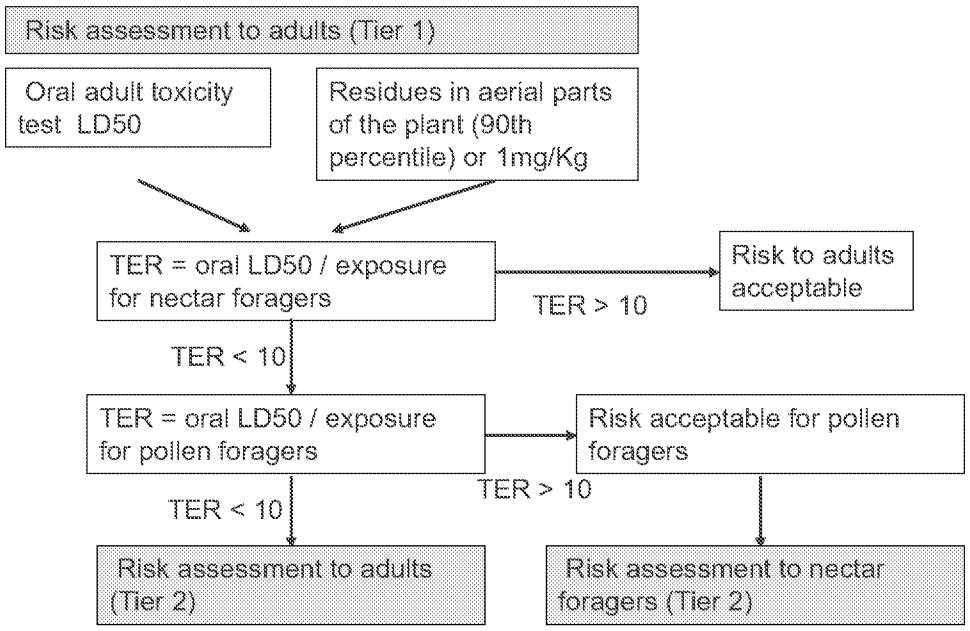
Where exposure cannot be excluded: If IGR -> brood test required A pesticides for which exposure may occur (greenhouse), all ais and formulations



# Recommended Tier 1 Seed/Soil - Adults and Larvae



# Recommended Tier 1 Seed/Soil - Adults



## New Candidate Tests for Tier 1 & 2 Adoption

- Recommend adoption of Larval *in vitro* chronic $LC_{50}$ method to yield NOEL/$LC_{50}$ for systemic AI's

  Based on method of Aupinel (ring tested and awaits OECD adoption) with modifications to simplify, increase throughput, and reduce costs completed in the near term ( Huang & Ellis)

- Once adopted same Larval test for microbial and GMO products possible (cost effective assessment)

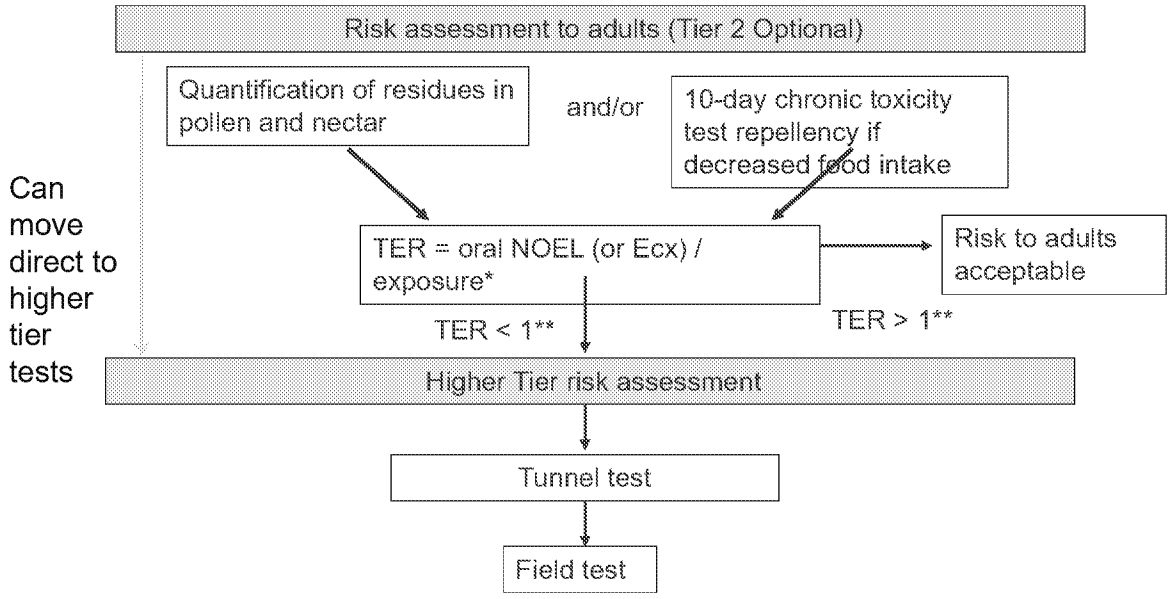
- Recommend development of a Chronic adult $LD_{50}$ test from those in various stages of testing with validation and adoption for Tier 2

  Agreement on measurement end points needed ( mortality, knock down, staggering, hypo or hyper responsiveness)

  Ring testing and validation of standard protocol needed

  Can trigger Tier 3 if TER NOEL <1 or possibly use $EC_X$ at designated level

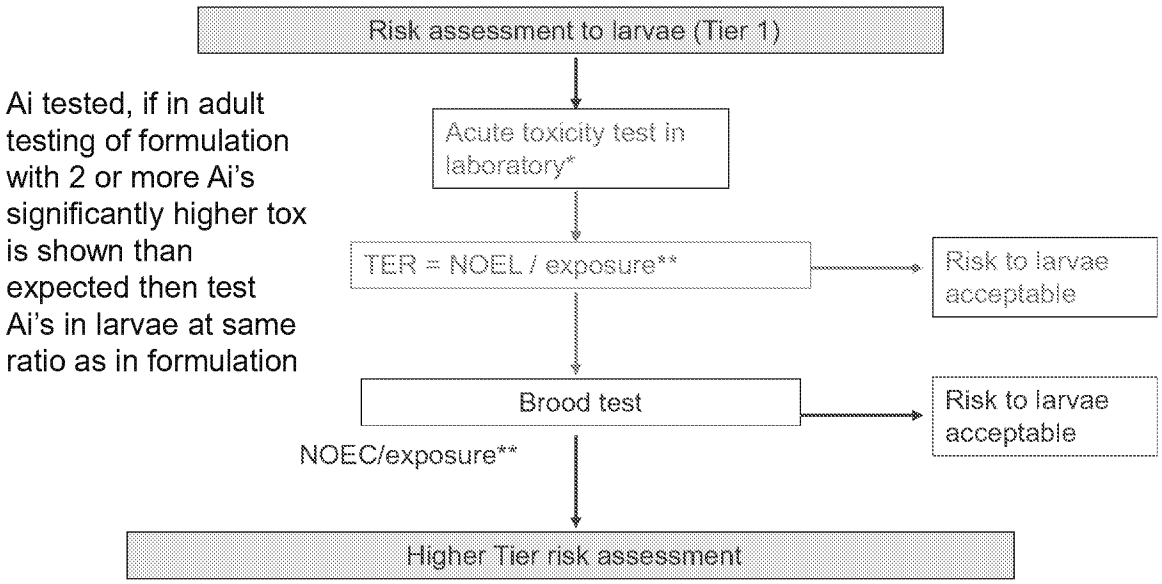
# Recommended Tier 2 Seed/Soil- Adults




*90 percentile of residue in pollen if 48 hr LD 50 used or 50th percentile if 10 day NOEL used

**TER lowered only for refined toxicity (NOEL)

# Recommended Tier 1 Spray & Seed/Soil- Larvae



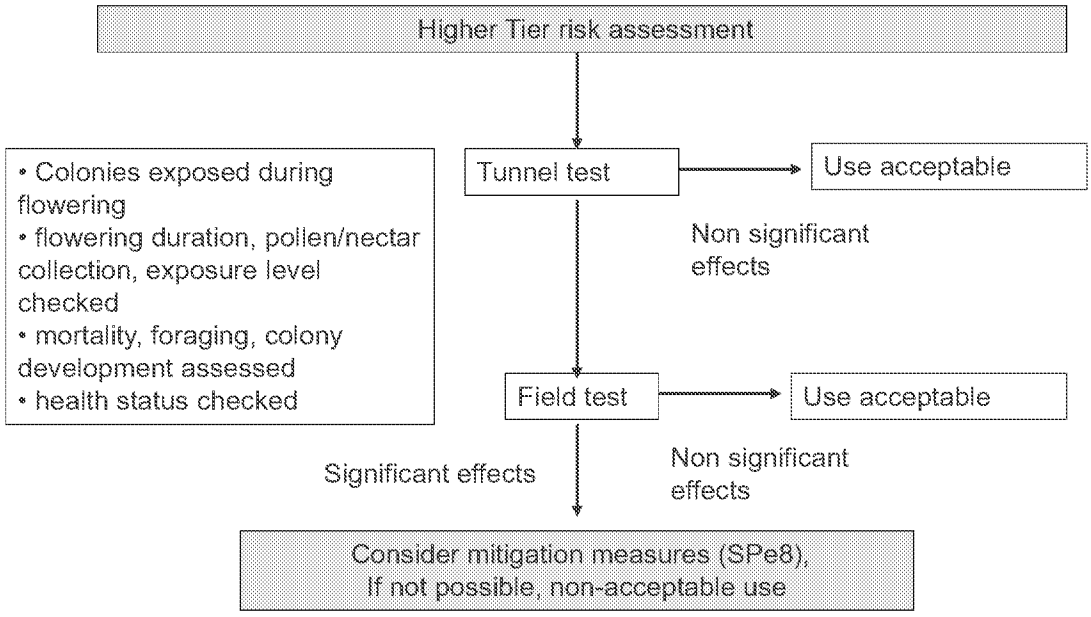

Ai tested, if in adult testing of formulation with 2 or more Ai's significantly higher tox is shown than expected then test Ai's in larvae at same ratio as in formulation

If high level of safety for adults, low level of potential exposure and non-IGR then further testing for larvae may be excluded/waived

* Method of Aupinel/ Huang/Ellis when validated

** Expected from aerial parts or measured 90th percentile of residues in pollen nectar if LC50 used or 50th percentile if NOEC used

# Recommended Higher Tier Tests



## Methods Requiring Further Development - High Priority Research

- Adult contact tests for non-Apis bees easily adapted from Apis Tier 1 Protocols
- Chronic Adult and Larval Tests for non-Apis bees of selected species require much development due to differences in feeding and development
- Methods to measure sub-lethal impacts on behavior and/or development

## Candidate Behavioral Tests on Apis and non-Apis bees for Protocol Development through further research

- Proboscus Extension Response ( PER) in Lab: Several studies of pesticide impacts by multiple authors, but relevance for foraging or other behaviors currently unclear
- Artificial flowers in semi-field cage
- Olfactory learning conditioning to scented flowers in cage
- Visual learning performance in a maze
- RFID tagged bees to measure foraging behavior over 6 day period
- Homing Flights