



# Risk to Bees from TreeAzin® Systemic Insecticide Injections for Emerald Ash Borer

The risk to bees from any emerald ash borer insecticide can be determined by how toxic the insecticide is to bees and the degree of exposure bees have to the insecticide: **Risk = Toxicity X Exposure**

## Toxicity

The active ingredient in TreeAzin Systemic Insecticide is azadirachtin, an extract from the neem seed. As a measurement of toxicity, the LD<sub>50</sub> of azadirachtin for honey bees is 6.1 µg/bee (Naumann and Isman 1996). By EPA's scale for rating toxicity (EPA et al. 2014), azadirachtin is moderately toxic to bees. In contrast, other active ingredients used for emerald ash borer (EAB) treatments, namely imidacloprid, dinotefuran, and emamectin benzoate, are all highly toxic to bees.

Emerald Ash Borer treatment options	Toxicity	Contact LD <sub>50</sub> (µg/bee)
Azadirachtin	Moderate	6.1 <sup>a</sup>
Dinotefuran	High	0.024 – 0.061 <sup>b</sup>
Imidacloprid	High	0.0179 – 0.24 <sup>b</sup>
Emamectin benzoate	High	0.0035 <sup>c</sup>

Sources: a. Naumann and Isman 1996; b. Hoodwood et al. 2012; c. EPA et al. 1992

## Exposure (i.e. likelihood of bees coming into contact with EAB insecticides)

- **Environmental persistence:** The longer an insecticide persists in the environment, the greater the likelihood that bees could come into contact with that insecticide
  - Foliar half-life of azadirachtin: 5.1 to 12.3 days (Kleeberg 1992; Grimalt et al. 2011).
  - Following summer injections, azadirachtin degrades to near undetectable limits in autumn shed leaves (Grimalt et al. 2011).
  - Azadirachtin in autumn-shed leaves poses no measurable risk of harm to terrestrial or aquatic decomposer invertebrates (Kreutzweiser et al. 2011).
  - Imidacloprid can persist in woody plants for more than a year (Bonmatin et al. 2014).
  - Autumn-shed leaves from imidacloprid treated trees can contain residues that pose risk of harm to terrestrial or aquatic invertebrates (Kreutzweiser et al. 2007, 2008, 2009).
  - Azadirachtin is a promising alternative to neonicotinoid insecticides because of its non-persistent environmental profile (Furlan and Kreutzweiser 2014).
- **Ash pollen:** Bees forage for ash pollen (Johnson 2015).
  - Stem injections occur long after trees have flowered, so possibility of exposure in year of treatment should be minimal (Hahn et al. 2011).
- **Repellency**
  - Honey bee workers are able to detect neem seed extract (NSE) concentrations as low as 0.1 ppm of NSE in sugar syrup. This detection is manifested in a tendency to avoid NSE-treated syrup in preference to untreated syrup. Because of the small amounts of NSE acquired by foragers on flowers, and the rapid degradation of NSE in the environment, it is unlikely that enough azadirachtin could be concentrated in the nest stores to affect larval development (Naumann et al. 1994).
- **Ingestion vs. contact**
  - Azadirachtin products must be ingested to be effective (Extoxnet 1995a), whereas imidacloprid, emamectin benzoate, and dinotefuran are effective on contact or ingestion (Extoxnet 1995b, EPA 2009, and Fishel 2013, respectively).

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