



Emerald Ash Borer Management Options

The emerald ash borer (EAB) is an exotic insect that is destructive to ash trees (*Fraxinus* species). It is considered one of the most destructive tree pests ever seen in North America. Although the adult beetle causes minor feeding damage on ash foliage, the larval stage feeds beneath the bark and disrupts water and nutrient flow within the tree, which leads to tree death. Larvae actively feed from early summer through fall.

The insecticide products listed in this publication work best as preventive treatments for healthy ash trees planted in yards or parks. Healthy trees have full crowns, elongating branches, and bark held tightly to the trunk and branches. It is not practical or cost effective to treat woodlot trees where timber production is the primary goal. Right-of-way ash trees may be good candidates for treatment, but will most likely be governed by municipal guidelines.



Properly applied systemic insecticides provide effective and consistent protection from EAB. Unprotected ash trees will die as a result of borer feeding. Before using an insecticide, several factors must be considered:

- Identify the tree as ash using the [Interactive Tree Identification Key](https://extension.iastate.edu/forestry/iowa_trees/tree_id.html) (extension.iastate.edu/forestry/iowa_trees/tree_id.html).
- Determine if the ash tree is already infested with EAB using [Common Problems of Ash Trees](https://store.extension.iastate.edu/Product/1482) (store.extension.iastate.edu/Product/1482).
- Estimate the tree's value in the community (see Table 1). Some benefits of urban trees include helping clean the air, slowing stormwater runoff, raising property values, storing carbon, and reducing energy costs.

Table 1. Estimated annual economic benefit of ash trees for a single family residence in Des Moines, Iowa*

Trunk Diameter (inches)	Black Ash	Green Ash	White Ash
5	\$35	\$33	\$32
10	\$86	\$86	\$95
15	\$141	\$147	\$177
20	\$181	\$197	\$266
25	\$215	\$250	\$359
30	\$209	\$300	\$478
35	\$191	\$346	\$488
40	\$191	\$376	\$346

* Based on [National Tree Benefit Calculator](https://www.treebenefits.com) (www.treebenefits.com).

- Evaluate tree health. If the tree is declining (dead branches, yellow leaves), storm damaged or has loose bark, replace the tree with an alternate species rather than treat. [Street Trees for Iowa Communities](https://extension.iastate.edu/psep/files/page/files/street_trees_for_iowa_communities.pdf) provides options (extension.iastate.edu/psep/files/page/files/street_trees_for_iowa_communities.pdf).
- For municipal forests, determine if it is best to treat trees or replace them. Purdue University developed a predictive mathematical model to help answer this question. For more information, visit the [Emerald Ash Borer Cash Calculator](https://int.entm.purdue.edu/ext/treecomputer) (int.entm.purdue.edu/ext/treecomputer).
- Evaluate soil moisture, soil compaction, and other site factors. Good soil moisture is very important to moving systemic insecticides throughout the tree. Soil compaction and restricted root zones can also influence a tree's ability to uptake systemic insecticides and determine how effective the treatment will be.
- Systemic insecticides are the product of choice when treating for the emerald ash borer. These chemicals are transported within the vascular system of the tree from the roots and trunk to the branches and leaves. Systemic insecticides reduce hazard such as drift of pesticides to nontarget sites or applicator exposure, and have less impact on beneficial organisms than broadcast sprays.
- Determine if the cost of treatment will exceed the tree's landscape value. Active ingredients dinotefuran and imidacloprid must be *used each year*. Emamectin benzoate protects ash trees for two years following treatment. Azadirachtin is effective for one or two years depending on the EAB population in the immediate area. **Any treatment must be done for several years to protect the tree.**
- Treat if the tree is in the treatment zone. Ash trees within 15 miles of a confirmed EAB site are at risk of attack. Preventive treatments are suggested within this risk zone, but may be premature if outside this area. Continued monitoring of ash trees is valuable outside the immediate risk area. Known Iowa infestations are provided on the [Iowa State University Extension and Outreach Pesticide Safety Education Program website](https://extension.iastate.edu/psep/emerald-ash-borer-eab) (extension.iastate.edu/psep/emerald-ash-borer-eab) and the [Iowa Department of Agriculture and Land Stewardship Emerald Ash Borer website](https://iowatreepests.com/eab_locations.html) (iowatreepests.com/eab_locations.html).
- Infested trees may or may not improve following treatment. Candidate trees with less than 30% dieback of the crown due to EAB feeding may recover following treatment. It is advised to remove dead branches to reduce fall hazard.
- Keep pollinators in mind. Broadcast applications (soil drench, soil injection, granular application or basal trunk sprays) should not be made where there are roots of flowering plants (annuals, perennials or shrubs) growing within the tree's drip line since these plants are visited by bees and other pollinators. For more information on the effect of neonicotinoid insecticides on pollinators see the Iowa State University Extension and Outreach publication [Protecting Bees from Pesticides](https://store.extension.iastate.edu/Product/14047) (store.extension.iastate.edu/Product/14047).
- Observe per acre use limitations. Soil-applied and basally-applied insecticides have limits on how much can be used per acre each year. Trunk-injected insecticides do not have annual use limitations. For more information, refer to product labels and Minnesota Department of Agriculture publication [Emerald Ash Borer Insecticides: Label Guidance for Use Limits](https://mda.state.mn.us/sites/default/files/inline-files/eablabeledguide.pdf) (mda.state.mn.us/sites/default/files/inline-files/eablabeledguide.pdf).
- Avoid broadcast sprays to tree crowns. Canopy sprays are not recommended because of a narrow treatment window, limited effectiveness, the need for special equipment, spray drift, and possible adverse effects to non-target organisms.



Treatment Notes – See Tables 2-4

Trunk injection. Requires 1-4 weeks for tree distribution. Trunk injections are useful where soil treatments are not practical (excessively wet soils, compacted sites, surface and groundwater considerations or restricted surface areas). Research has shown that tree injections are tolerated in healthy green ash trees, especially if treatments are applied according to label directions, small volumes of product are injected, and injection holes are made using sharp bits drilled to the proper depth.

Soil drench. Requires 4-8 weeks for tree distribution. Before applying a soil drench, pull back any mulch or dead leaves 12 inches from the base of the tree. After

treatment, reposition mulch over the treated area once the mixture has been absorbed into the soil. Do not make soil applications when soil is saturated or frozen.

Soil injection. Requires 4-8 weeks for tree distribution. Soil injections should be made within 12-18 inches of the trunk, and the solution placed 2-4 inches beneath the soil surface.

Basal trunk spray. Requires 1-4 weeks for tree distribution. This treatment is applied to the tree trunk from the root flares at the soil surface to 5-6 feet above the soil surface. Surfactants (bark penetrants) may be recommended on product label. Best results have been observed for trees up to 23 inches in diameter at breast height (DBH) – 4.5 feet above ground.

Table 2. Toxicity of systemic insecticides to emerald ash borer life stages Source: Cliff Sadof, Purdue University.

Insecticide	Eggs	Larval stage				Adults
		L1	L2	L3	L4	
Imidacloprid	No	Yes	Yes	No	No	Sustained feeding
Dinotefuran	No	Yes	Yes	No	No	A few bites
Emamectin benzoate	No	Yes	Yes	Yes	Yes	One or two bites
Azadirachtin	No	Yes	Yes	Yes	Yes	Reduces fecundity; no mortality

Table 3. Products for homeowners. Carefully follow label directions¹

Type of Application	Active Ingredient	Tree Size – trunk circumference (diameter at 4.5 feet [DBH])	Time of Application ²
Soil drench ³	Imidacloprid (1.47%) ⁴	Up to 60" (20" DBH)	Mid-April to mid-May OR early August to mid-Sept
Soil drench ³	Imidacloprid (2.94%) ⁵	Up to 60" (20" DBH)	Mid-April to mid-May OR early August to mid-Sept
Soil drench ³	Imidacloprid (21.4%) ⁶	Up to 60" (20" DBH)	Early August to mid-Sept
Soil drench ³	Imidacloprid (0.74%) + Clothianidin (0.37%) ⁷	Up to 60" (20" DBH)	Mid-April to mid-May OR early August to mid-Sept
Granular ⁸	Dinotefuran (2%) ⁹	Up to 36" (12" DBH)	Mid-April to mid-May
Granular ⁸	Imidacloprid (0.55%) + Clothianidin (0.275%) ¹⁰	Up to 36" (12" DBH)	Mid-April to mid-May
Granular ⁸	Imidacloprid (1.1%) ¹¹	Up to 36" (12" DBH)	Mid-April to mid-May

¹ The amount of insecticide required depends on the tree's circumference in inches; see product label directions.

² If the product label lists spring and fall as possible treatment times, homeowners can treat only ONCE per year. University research has shown spring applications are more effective than fall applications at the same rate. Fall applications do not affect overwintering larvae or pupae, but target the next year's adults and first instar larvae.

³ Before applying a soil drench, pull back any mulch or dead leaves 12" from the base of the tree. After treatment, replace mulch over the treated area once the mixture has been absorbed into the soil. For trees larger than 60" circumference, enlist the services of a commercial pesticide applicator. Do not make soil applications when soil is saturated or frozen.

⁴ Examples of products include: Amdro Tree & Shrub Care Concentrate, Bioadvanced Science-based Solutions 12-month Tree & Shrub Protect & Feed Concentrate, Bonide Annual Tree & Shrub Insect Control with Systemaxx, Compare -N -Save Systemic Tree & Shrub Insect Drench, Earl May Tree & Shrub Insect Control, Ferti-Lome Systemic Insect Spray, Hi-Yield Systemic Insect Spray, Martin's Dominion Tree & Shrub, and Spectracide Grub Killer Concentrate.

⁵ An example of product is Bioadvanced Science-based Solutions 12-Month Tree & Shrub Insect Control.

⁶ An example of product is Optrol Insect Control.

⁷ An example of product is Bioadvanced Science-based Solutions 12-month Tree & Shrub Protect & Feed Concentrate.

⁸ Spread granules evenly on the soil around the base of the plant within 18" of the trunk. Irrigate after application with enough water to dissolve granules and move product into the root zone.

⁹ An example of product is Ortho Tree & Shrub Insect Control Granules.

¹⁰ An example of product is Bioadvanced Science-based Solutions 12-month Tree & Shrub Protect & Feed Ready-to-use Granules.

¹¹ An example of product is Bioadvanced Science-based Solutions 12-month Tree & Shrub Protect & Feed Ready-to-use Granules.

Table 4. Products for Commercial Pesticide Applicators

Product (Formulation)	Active Ingredient	Application Method	Time of Application ¹
Arbormectin™	Emamectin benzoate	Trunk injection	Full canopy: Early spring to late-Aug
ArborMectin™	Emamectin benzoate	Trunk injection	Full canopy: Early spring to late Aug
Criterion™ (2F, 75WSP)	Imidacloprid	Soil injection or drench	Spring: Early April to mid-May
IMA-jet™	Imidacloprid	Trunk injection	Full canopy: Post bloom
Imicide®	Imidacloprid	Trunk injection	Full canopy: Post bloom
Mectinite™	Emamectin benzoate	Trunk injection	Full canopy: Early spring to late Aug
Merit® (2F, 75WSP)	Imidacloprid	Soil injection or drench	Spring: Early April to mid-May
Merit®Tree Injection	Imidacloprid	Trunk injection	Full canopy: Post bloom
Safari® (20SG)	Dinotefuran	Soil injection or drench	Spring: Late-April to late-May
Safari® (20SG)	Dinotefuran	Basal trunk spray	Spring: Mid-May to mid-June
Transtect™ (70WSP)	Dinotefuran	Soil injection or drench	Spring: Late-April to late-May
Transtect™ (70WSP)	Dinotefuran	Basal bark spray	Spring: Mid-May to mid-June
TREE-äge® G4	Emamectin benzoate	Trunk injection	Full canopy: Early spring to late Aug
TREE-äge® R10 ²	Emamectin benzoate	Trunk injection	Full canopy: Early spring to late Aug
TreeAzin™	Azadirachtin	Trunk injection	Spring: Early May to mid-June
Xytect™ (2F, 75WSP)	Imidacloprid	Soil injection or drench	Spring: Early April to mid-May
Xytect™ (10% Infusible)	Imidacloprid	Trunk injection	Full canopy: Post bloom
Zylam® Liquid Systemic	Dinotefuran	Soil injection or drench	Spring: Late-April to late-May
Zylam® Liquid Systemic	Dinotefuran	Basal bark spray	Spring: Mid-May to mid-June

¹ Applications should be made after the ash tree has bloomed to adhere to pollinator protection statements on product labels.

² Restricted use insecticide.

For more information Contact your Iowa State University Extension and Outreach office or [visit the emerald ash borer website](http://www.extension.iastate.edu/psep/emerald-ash-borer-eab) for additional information (extension.iastate.edu/psep/emerald-ash-borer-eab).

Prepared by Mark Shour, industry extension specialist in entomology; Laura Iles, director and extension plant pathologist with the Plant and Insect Diagnostic Clinic; Donald Lewis, professor and extension entomologist; Jeff Iles, professor and extension specialist in horticulture; and Billy Beck, assistant professor and extension forestry specialist at Iowa State University. Photography provided by Mike Kintner, Entomologist – Iowa Department of Agriculture & Land Stewardship; Steven Pregler, City Forester – Park Division, City of Dubuque, Iowa (retired); College of Agricultural & Life Sciences, University of Wisconsin-Madison.

This institution is an equal opportunity provider. For the full non-discrimination statement or accommodation inquiries, go to www.extension.iastate.edu/diversity/ext.

